

1. Pipe and joints shall meet one of the following minimums:
  - a. Pipe sizes 4-inch through 12-inch:
    - 1) AWWA C900, pressure Class 150, thickness Class DR 18.
    - 2) ASTM D2241, pressure Class 250, thickness Class SDR 17.
  - b. Pipe sizes 14-inch through 36-inch: AWWA C905, pressure Class 150, thickness Class DR 18.
2. Elastomeric Joints: ASTM D3139
3. Piping Systems (Plant Piping)

## 2.03 RESTRAINED JOINT PVC PIPE

- A. Water Main or Sanitary Sewer.
  1. Acceptable manufacturer is Certanteed Certa-Lok C900/RJ PVC pipe or equal.
  2. Pipe shall be manufactured in accordance with the following standards:
    - a. Pipe sizes 4-inch through 12-inch: AWWA C900, pressure Class 235, thickness Class DR 18 in right-of-way or easements (non-traffic areas).
    - b. Pipe sizes 4-inch through 12-inch: AWWA C900, pressure class 305, thickness Class DR 14 in traffic areas.
  3. Restrained Joint Couplings
    - a. Non-metallic restrained type couplings. Pipe and couplings shall be designed as an integral system and shall be provided by a single manufacturer for maximum reliability and interchangeability. Pipe and couplings shall be joined using high-strength flexible plastic splines inserted into mating precision-machined grooves, which align when the pipe is fully inserted provided a full 360° restraint with evenly distributed loading. No external pipe-to-pipe restraining devices that clamp onto or otherwise damage the pipe surface as a result of point loading shall be permitted.

## **PART 3 - EXECUTION**

### 3.01 PVC INSTALLATION

- A. Install PVC piping in accordance with manufacturer's written instructions.
- B. Refer to applicable section for installation procedures.

- END OF SECTION -

## SECTION 02623

### POLYETHYLENE PIPE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Work included: This section includes material and performance requirements for polyethylene pipe and fittings.
- B. Related Section and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 01563, Erosion Control.
  - 4. Section 01661, Testing and Inspection of Pipeline Construction.
  - 5. Section 02290, Soils and Aggregates.
  - 6. Section 02220, Trenching, Backfilling and Compaction.
  - 7. Section 02565, Forcemain
  - 8. Section 02660, Watermain
  - 9. Section 02730, Sanitary Sewer.
  - 10. Section 15050, Method and Materials for Process Piping Installation: Exposed.

##### 1.02 QUALITY ASSURANCE

- A. Pipe shall be available to Owner's Representative for inspection.
- B. Pipe shall be considered defective and will be rejected when:
  - 1. Pitted or cratered.
  - 2. Flaking.
  - 3. Any defect that prevents assembly according to manufacturer's recommendations.
  - 4. Not utilized within six (6) months of date of production.
- C. Material brands and/or pipe classes shall not be mixed.

##### 1.03 PRODUCT DELIVERY

- A. Pipe Marking - pipe shall be marked as follows:
  - 1. Manufacturer's name, trademark, or logo.
  - 2. Nominal size.
  - 3. SDR rating.
  - 4. Production date.
- B. Storage:
  - 1. Provide a protected storage area.
  - 2. Keep pipe material safe from damage and theft.
  - 3. Protect pipe material from direct rays of the sun.

## 1.04 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300, Submittals, including:
  - 1. Certification of production date of all materials.
  - 2. Manufacturer's certification that materials delivered comply with requirements of this section.

## **PART 2 - PRODUCTS**

### 2.01 GENERAL

- A. All pipe and fittings shall be the product of one manufacturer.

### 2.02 MATERIALS

#### A. Pipe

- 1. Pipe materials furnished under this section shall be high-density polyethylene pipe, D.I.P.S., P.E.-3408, in accordance with ASTM D-1248, Type III, Class C, Category 5, Grade P34.
- 2. The polyethylene pipe material shall exceed an environmental stress crack resistance of 1500 hours, Condition C in accordance with ASTM D-1693; shall have a nominal tensile yield strength of 3,500 psi in accordance with ASTM D-638; shall have a minimum Elongation of Break of 600% in accordance with ASTM D-638; and shall have a minimum Modulus of Elasticity of 110,000 psi in accordance with ASTM D-638. The polyethylene pipe shall have an average molecular weight equal to 250,000 psi as per GPC (Contractor shall provide certification).
- 3. The polyethylene pipe shall have a manufacturer's recommended hydrostatic design basis of 1,600 PSI determined in accordance with ASTM D-2837. The dimensional characteristics and pressure capabilities shall be in accordance with ASTM F-714. The pipe shall have an SDR of 11 or less for pressurized pipes and SDR of 17 or less for non-pressurized pipes.
- 4. The polyethylene pipe shall have an internal pressure rating of 160 psi at 75°F temperature and at a service life of 50 years. The pressure rating shall be calculated in accordance with ISO recommendation ISO-R161.

#### B. Fittings

- 1. Fittings shall be molded or fabricated and shall be of the same type, grade, and class of polyethylene resin as the pipe is manufactured from. Fittings shall be manufactured by the same manufacturer as the pipe or approved supplier.
- 2. Fittings for joining polyethylene pipe to other pipe materials shall be molded stub end type with flange back-up ring. All other pipe material fittings shall be M. J. and restrained using Megalugs by EBAA Iron or equal.

#### C. Joints

- 1. Joints shall be butt fused in strict accordance with pipe manufacturer's recommendations. The joints shall develop all strength properties equal to or greater than those of the pipe material.
- 2. Ductile iron expansion / contraction joints shall be as manufactured by EBAA Iron or equal and shall allow for a minimum of 12-inch expansion/contraction

#### D. Flange Joints:

- 1. Type 304 stainless steel backup flanges as recommended by the manufacturer.

2. Type 316 stainless steel nuts and bolts.
  3. Flanges and bolt patterns as recommended by the manufacturer.
- E. Tracer Wire
1. Tracer wire shall be No. 10 AWG, single conductor with Type UF insulation rated for direct burial service.
  2. Tracer wire splices shall be made with 3M Scotch Cats, Ideal Twister DB Plus, or equal.
  3. Tracer wire signal connection box shall be three-piece, 5 1/4-inch cast iron valve box with top marked, "Sewer" as manufactured by Clow, Tyler, or equal.
- F. Drilling Fluids
1. Drilling fluids composition shall meet permit requirements and environmental regulations.
- G. Water
1. Contractor shall procure, transport, and store water required for his operations.

### **PART 3 - EXECUTION**

#### **3.01 FIELD QUALITY CONTROL**

- A. Pipe may be rejected for failure to conform to the Specifications, or:
1. Fractures or cracks passing through the pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of the shipment or delivery.
  2. Cracks sufficient to impair strength, durability or serviceability of pipe.
  3. Defects indicating improper proportioning, mixing, and molding.
  4. Damaged ends, where such damage would prevent making satisfactory joint.
- B. Acceptance of fittings, stubs or other specially fabricated pipe sections shall be based on visual inspection at the job site and documentation they conform to these Specifications.

#### **3.02 INSTALLATION**

- A. Trench, backfill, and compact in accordance with Section 02220.
- B. Heat Fusion of Pipe:
1. Weld in accordance with manufacturer's recommendation for butt fusion methods. Qualified fusion operators shall be provided by the Contractor.
  2. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by the pipe manufacturer, including but not limited to, temperature requirements, alignment, and fusion pressures.
  3. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with the manufacturer's recommendations.
  4. Do not bend pipe to a greater degree than minimum radius recommended by the manufacturer for type and grade.
  5. Do not subject pipe to strains that will overstress or buckle piping or impose excessive stress on joints.

6. Branch saddle fusions shall be joined in accordance with the manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of size to facilitate saddle fusion within trench.
7. Before butt fusing pipe, inspect each length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe.
8. At end of each working day, cover open ends of fused pipe. Cap to prevent entry by animals or debris.
9. Use compatible fusion techniques when polyethylenes of different melt indexes are fused together. Refer to the manufacturer's specifications for compatible fusion.

C. Flange Jointing:

1. Use on flanged pipe connection sections.
2. Connect stainless steel backup flanges with stainless steel nuts and bolts.
3. Butt fuse fabricated flange adapters to pipe.
4. Observe the following precautions in connection of flange joints.
  - a. Align flanges or flange/valve connections to provide tight seal. Provide nitrile-butadiene (hycar) gaskets. Gaskets are required for flange/valve connections.
  - b. Place U.S. Standard round washers as may be required on some flanges in accordance with the manufacturer's recommendations. Lubricate bolts in accordance with the manufacturer's recommendations.
  - c. Tighten flange bolts in sequence and accordance with the manufacturer's recommendations. CAUTION: Do not overtighten bolts.
5. Pull bolt down by degrees to uniform torque in accordance with the manufacturer's recommendations.
6. Install expansion / contraction joints as shown on the plans.

D. Pipe Placement:

1. Grade control equipment shall be of type to accurately maintain design grades and slopes during installation of pipe.
2. Dewatering: remove standing water in trench before installation of pipe.
3. Unless otherwise specifically stated, install pipe according to the methods and practices in accordance with the manufacturer's recommendations.
4. Maximum lengths of fused pipe to be handled as one section shall be placed according to the manufacturer's recommendations as to pipe size, pipe SDR and topography, so as not to cause excessive gouging or surface abrasion; but not to exceed 400 feet.
5. Cap pipe sections longer than single joining (usually 40 feet) on both ends during placement except during fusing operations.
6. Prevent migration of dirt and debris through perforations during placement. Remove dirt or debris from pipe before backfilling.
7. Notify the Engineer prior to installing pipe into trench and allow time for the Engineer's inspection.
8. Correct irregularities found during inspection.
9. Complete tie-ins within trench whenever possible to prevent overstressed connections.
10. Complete flanged branch saddle connections with trench.
11. Allow pipe sufficient time to adjust to trench temperature prior to testing, segment tie ins, or backfilling activity.
12. Install reducers adjacent to laterals and tees.
13. To reduce branch saddle stress, install saddles at slope equal to and continuous within 4-inch lateral piping.
14. Place in trench by allowing at least 12 in./100 ft. for thermal contraction and expansion.

### 3.03 FINAL CONNECTIONS

- A. No final connections to the pipe and fittings can be made until the pipe has been installed for a minimum of seven days.
- B. Engineer must be present for all final connections.

### 3.04 PIPE TESTING

- A. Test pipe sections in accordance with Section 01661.

### 3.05 TRACER WIRE

- A. Provide the following for identification of underground header.
  - 1. Install tracer wire and tape wire to top of pipe. Wire shall be exposed at all penetrations of the cover and at all vertical risers.

- END OF SECTION -

## **SECTION 02660**

### **WATER MAIN**

#### **PART 1 -GENERAL**

##### **1.01 SUMMARY**

- A. Work Included: This section includes water main installation, materials, and restoration.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 01563, Erosion Control.
  - 4. Section 01661, Testing and Inspection of Pipeline Construction.
  - 5. Section 02220, Trenching, Backfilling and Compaction.
  - 6. Section 02290, Soils and Aggregates.
  - 7. Section 02600, Buried Piping and Appurtenances
  - 8. Section 02616, Ductile Iron Pipe.
  - 9. Section 02622, PVC Plastic Pipe.
  - 10. Section 02623, Polyethylene Pipe.
  - 11. Section 02936, Landscaping.

##### **1.02 REFERENCE STANDARDS**

- A. American Water Works Association (AWWA).
- B. American Society for Testing and Materials (ASTM).
- C. American Society of State Highway and Transportation Officials (ASSHTO).

##### **1.03 SUBMITTALS**

- A. Submit the following in accordance with Section 01300, Submittals including the following:
  - 1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
  - 2. One copy of all test reports.

#### **PART 2 - PRODUCTS**

##### **2.01 PIPE MATERIAL**

- A. Ductile Iron Pipe shall conform to Section 02616, Ductile Iron Pipe.
- B. PVC Pipe shall conform to Section 02622, PVC Plastic Pipe.
- C. Polyethylene pipe shall conform to Section 02623, Polyethylene Pipe.

## 2.02 HYDRANTS

- A. Manufacturer: Waterous Pacer WB-67 or equal, conforming to AWWA C502.
- B. Hydrants shall have 5¼-inch main valve opening, 6-inch mechanical joint connection, standard pentagon operating nut, two 2½-inch hose connections, and one 4½-inch pumper connection.
- C. Hydrants shall be provided with O-ring seals and compression type shut off.
- D. All buried bolts on the hydrant body shall be Type 304 stainless steel. All stainless steel threads shall be coated with anti-seize compound prior to assembly.
- E. Depth of Bury shall be as required to conform to the hydrant flange elevations as shown on plans or a 7.5-foot minimum measured from the bottom of inlet to the hydrant ground line. No additional compensation will be allowed for hydrant extensions if required.
- F. Color shall be Red.
- G. Equip hydrants with a break-away safety flange and coupling at the ground line.

## 2.03 VALVES

- A. Resilient Gate Valve
  - 1. Manufacturer shall be American Flow Control Series 2500, or equal.
  - 2. Resilient encapsulating wedge valve shall be used in water main sizes 4-inch through 12-inch.
  - 3. Valves shall conform with AWWA C515.
  - 4. Stem shall be non-rising.
  - 5. Valve body and bonnet shall be epoxy coated inside and out, conforming to AWWA C550. All bonnet bolts shall be Type 304 stainless steel. All stainless steel threads shall be coated with anti-seize compound prior to assembly.
  - 6. Waterway shall be smooth with no cavities or depressions in seat area.
- B. Valve Boxes
  - 1. Manufacturer shall be Clow, Tyler, Sigma, or equal.
  - 2. Valve boxes shall be cast iron, three-piece, screw-type -- Cast Iron.
  - 3. Shaft shall be 5¼-inch diameter.
  - 4. Lid shall be diameter drop type, anti-rattle and marked "Water."
  - 5. Base shall be round or oval, sized to fit valve.
  - 6. Provide Valve box hangers, Adaptor Inc., or equal.
- C. Valve Box Hangers: Manufacturer shall be Adaptor Inc. or equal.

## 2.04 FITTINGS

- A. Conform with AWWA C150 and C151.
  - 1. All fittings shall be the product of one manufacturer
- B. Mechanical Joint 3-inch through 24-inch:
  - 1. Class 52.



2. Rated Pressure 350 psi.

C. Coating and Lining:

1. Exterior Coating: Asphaltic Coating, minimum of 1-mil. thick.
2. Interior Lining: Standard thickness of cement-mortar conforming with AWWA C104.

2.05 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall conform with AWWA C105.
- B. Polyethylene encasement shall be Class C Black, Type 1 and Grade E-1.
- C. Thickness shall be 8 mils minimum.

2.06 WATER SERVICE MATERIAL

A. Copper Tubing

1. Type "K" conforming with AWWA C800.

B. Corporation Stops

1. Manufacturer shall be Mueller H-15008, McDonald 4701 Q, or equal.
2. Corporation stops shall conform with AWWA C800.
3. Inlet shall have AWWA standard thread.
4. Outlet shall be compression.

C. Curb Stops

1. Manufacturer shall be Mueller B-25155, McDonald 6104 Q, or equal.
2. Curb stops shall conform with AWWA C800.
3. Inlet and outlet shall be compression.

D. Curb Boxes

1. Curb boxes shall be Mueller H-10300 or McDonald 5614 for ½ to 1-inch curb stops, H-10302 or McDonald 5614 for 1¼-inch, and H-10300 or McDonald 5615 for 1½-inch and 2-inch curb stops or equal.
2. Minneapolis pattern with 1¼-inch upper section.
3. Lid shall be plug style with pentagon bolt and marked "WATER."
4. The curb boxes shall extend 7 feet and be complete with stainless steel stationary rods and stainless steel pin.
5. Base size shall match curb stop size.
6. Two curb box keys and wrenches per contract or one per thirty curb boxes, whichever number is greater.

E. Service Saddles

1. Manufacturer shall be Romac 306, Smith Blair 372, Cascade CSC2, or equal.
2. Service saddles shall be used when tapping PVC water main.

F. Fittings

1. Fittings for copper water service piping shall be of cast brass having an alloy of 85% copper, 5% zinc, and 5% lead.

2. Fittings shall have a uniform wall thickness and strength, and shall be free of defects, which may affect their serviceability.
3. Fittings shall be of the flared and compression type only.
4. Unions shall be extra heavy 3-part type.

#### 2.07 TRACER WIRE

- A. Tracer wire shall be No. 10 AWG, copper, single conductor with Type UF insulation rated for direct burial service.
- B. Tracer wire splices shall be made with 3M Scotch Cast, Ideal Twister DB Plus, or equal.
- C. Tracer wire signal connector box shall be three-piece 5¼-inch cast iron valve box with top marked, "Water" as manufactured by Clow, Tyler, or equal.

#### 2.08 PIPE BEDDING AND BACKFILLING

- A. Trenching, backfilling and compaction shall be in accordance with Section 02220, Trenching, Backfilling and Compaction and standard details on the drawings.

#### 2.09 THRUST BLOCKING

- A. Thrust blocks shall be constructed of concrete having a minimum 28-day compressive strength of 2,000 psi. Hardwood blocking may be used, if approved by the Engineer.
- B. The minimum cement content shall be 4½-pound bags of cement per cubic yard of concrete. The allowable slump shall be 4 to 5 inches
- C. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown or required by the Engineer.
- D. The blocking shall, unless otherwise specified or required, be placed so that the pipe and fitting joints will be accessible for repair.
- E. A piece of 15-pound building paper or other approved material shall be placed between the cap or plug and the concrete.

#### 2.10 JOINT RESTRAINT MATERIAL

- A. Rods shall be ¾-inch diameter, Type 304, or 316 Stainless Steel.
- B. Underground clamps shall conform to the following:
  1. ½-inch x 2 inches flat bar stock clamps, Astral Corp., or equal.
  2. Clamps shall include retainer washer.
- C. T-bolts shall be Type 304 or 316 stainless steel.
  1. All stainless steel threads shall be coated with nickel based anti-seize compound prior to assembly.

2. In lieu of anti-seize compound, a green fluoropolymer coated stainless steel nut may be substituted. The coating shall be FlourKote#1 manufactured by Metal Coatings Corporation.
- D. Megalugs, by EBAA iron, Sigma "One-Lok", or equal may be used for joint restraint.

## 2.11 BUILT UP MASTIC COATINGS

- A. Materials shall be applied in full accordance with manufacturer's recommendations. Coating shall be Tapecoat, TC Mastic, or equal.

## **PART 3 - EXECUTION**

### 3.01 GENERAL

- A. Before excavation of trenches begins, the Contactor shall uncover the end of the existing water main to which the new main is to be connected. This will permit adjustments in line and grade to avoid using extra fittings. The exposed end of an existing main must be protected and blocked by the Contractor to prevent the blowing out of the plug or cap at the end of the main.
- B. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings, and special castings to prevent breakage and coating damage. Any significant damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped into the trench or so handled as to receive hard blows or jolts. All mud or concentration of dirt shall be removed prior to installation.
- C. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During the laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.
- D. At all times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means accepted by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry. No pipe shall be laid in water or when trench conditions are unsuitable.

### 3.02 PIPE INSTALLATION

- A. Pipe installation shall conform with Section 02220, Trenching, Backfilling and Compaction and bedding details shown on the drawings.
- B. Lay pipe to line and depth shown on plans. Unless otherwise stated, pipe shall be laid with the bell ends facing the direction of laying. When grade exceeds two feet per hundred feet, the bells shall face upgrade.

- C. When the depth is not shown on the plans, bury the pipe with 6.5 feet of cover as determined from the top of pipe to the finished ground elevation.
- D. Keep pipe, fittings, and hydrants free of debris and foreign matter. The interior of all pipes shall be clean before being installed. The Contractor shall provide the necessary means to wipe, brush, swab, or air blast to remove foreign matter.
- E. Assemble all joints in accordance with manufacturer's recommendations.
- F. Utilize full lengths of pipe, except at fittings.
- G. Provide thrust blocking or restraints at the following locations:
  - 1. Bend deflecting 11½ degrees or more.
  - 2. Hydrants.
  - 3. Valves and tees.
  - 4. Plugs and caps.
- H. When it is necessary to interrupt an existing system to complete construction, adhere to the following:
  - 1. No valves, controls, or appurtenances shall be operated by the Contractor.
  - 2. Operation of existing valves, controls, and appurtenances for interruption of existing service shall be done by Owner personnel at the Owner's convenience and normal working schedule.
  - 3. Contact owner a minimum 24 hours prior to an anticipated interruption.

### 3.03 HYDRANTS

#### A. General

- 1. Hydrants shall be set on hardwood blocking and in concrete thrust blocks as shown in the detail. Immediately before installation of hydrants, the following operation shall be performed:
  - a. The hydrant shall be thoroughly inspected and cleaned on the interior.
  - b. The hydrant shall be opened and closed as many times as necessary to determine if all parts are in proper working order.

#### B. Location and Position

- 1. Hydrants shall be located as shown or as required to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.
- 2. When placed behind the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 18 inches nor more than 24 inches from the gutter face of the curb, unless otherwise shown on drawing details.
- 3. When set in the lawn space between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 6 inches of the sidewalk.
- 4. All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to the curb, with the pumper nozzle facing the curb, except that hydrants having two hose nozzles 90 degrees apart shall be set with each nozzle facing the curb at an angle of 45 degrees. Hydrants shall be set to the established grade, with nozzles at least 18 inches above the ground as shown or as required by the Engineer.

#### C. Hydrant

1. Drainage shall be provided by placing crushed stone around the hydrant as shown on the detail. The minimum amount of crushed stone shall be 6 inches above the waste opening in the hydrant, and 1 foot around the hydrant.

### 3.04 VALVES

- A. Install as shown on the drawings.
- B. Provide gate valves for sizes through 12 inches.
- C. Provide butterfly valves for sizes 14 inches and larger.
- D. Install valve boxes plumb, and centered over valve operating nut:
  1. Install in a manner that will prevent shock loads and stress being transmitted to the valve and water main.

### 3.05 POLYETHYLENE ENCASEMENT

- A. Wrap all below ground metal in accordance with AWWA C105, including:
  1. Ductile iron pipe.
  2. Fittings, valves, and valve boxes.
  3. Corporations, curb stops, and curb boxes - their entire length.
  4. All portions of hydrants below grade.
  5. Copper water services.
  6. All metal restraining devices.

### 3.06 WATER SERVICES

- A. Water services shall conform with all plumbing codes.
- B. Terminate services at the property line or easement line as shown on the plans.
- C. Unions may not be used unless approved by Owner's Representative.
- D. Connection to water main/  
Water services shall be made by tapping the water main for the corporation stop unless use of a service saddle is required. The corporation stop connection shall be a minimum of 1 foot from any pipe or fitting joint and must have a minimum of 1 foot between connections and stagger 30° around the circumference of the water main.
- E. All polyethylene water services shall have tracer wire brought up and cable wrapped with zip ties to the outside of the curb box. Tracer wire shall be extended to the termination point of the service.
- F. All connections to water main shall be under system pressure when the water services are installed as part of relay construction. All connections to water main during new construction shall be under system pressure and tested when the water main is tested.
- G. Corporation Stops, Curb Stops, and Curb Boxes

Unless specified otherwise, the Contractor shall provide and install one corporation stop, curb stop, and curb box, at each water service. Corporation stop and curb stop shall be service line size unless specified otherwise.

H. Position and Grade

In common trench construction, the water service shall be run parallel and a minimum of 12 inches above the sanitary sewer lateral. The water service shall be laid with a minimum cover of 6 feet or shall be insulated with acceptable material. The curb stop shall be placed between 6 and 7 feet below established or proposed grade.

I. Setting the Curb Box

The curb box shall be centered over the curb stop and shall be brought to proper grade. The legs of the service box shall rest firmly upon a 2-inch x 5-inch x 8-inch hardwood board or 4-inch x 8-inch x 16-inch solid concrete block. Clearance shall be provided so that the service box does not rest upon the water service pipe. Where the bench does not afford a firm support for the service box blocking, such support shall be finished by the use of a 2-inch by 6-inch plank placed across the building sanitary sewer trench and firmly supported in each bank.

The curb box shall be plumbed and braced so it will remain vertical throughout the backfilling. Sufficient excavation shall be made for the curb box installation to ensure proper setting and backfilling around the curb box.

Before placing backfilling around the curb service box, the Contractor shall wrap polyethylene around the base, and bedding material shall be tamped in place from a point above the main to a point 6 inches above the blocking to prevent entrance of backfill materials into the openings at the base.

J. Protection of Curb Stop and Service Pipe

A copper disc shall be inserted in the curb stop coupling on the building side. The open end of copper water services shall be closed by peening the end.

3.07 TRACER WIRE

- A. Run tracer wire along pipe from hydrant to hydrant.
- B. Tape wire to each length of pipe at a minimum of two points.
- C. A maximum of one splice will be allowed between each hydrant.
- D. Tracer wire shall be tested for continuity prior to acceptance of project.

3.08 PROTECTION OF BURIED METAL SURFACES

- A. All steel clamps, rods, bolts, and other metal accessories using reaction anchorage or joint harness and all mechanical pipe fittings installed underground shall be protected with a built-up mastic coating and covered with a polyethylene in accordance with this section.
- B. Surfaces shall be cleaned by wire brushing immediately prior to application of the mastic.
- C. The mastic shall be molded firmly to encase all bolts, nuts, clamps, straps and flanges, and built-up to a uniform surface over the entire fitting.

### 3.09 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves shall be of the flanged outlet type designed for attachment to the flanged inlet end of the tapping valve. Sleeve shall be rated for 150-psi working pressure.
- B. Tapping sleeves shall be of cast iron or of Type 304 stainless steel construction.
- C. With the exception of valve ends and oversize seat rings to permit entry of the drilling machine cutters, tapping valves shall conform to the requirements of AWWA C509.
- D. Each tapping valve shall be provided with a flanged inlet end for attachment to the outlet flange of the tapping sleeve, and with an outlet end suitable for attachment of a drilling machine and the type of pipe used. Unless otherwise specified, each tapping valve shall be arranged to turn left (counterclockwise) to open and shall be provided with a 2-inch operating nut and valve box.
- E. Each tapping sleeve and valve assembly shall be furnished and installed complete with gaskets as required and with all bolts for the sleeve and for the flanged connection between the sleeve and valve, in strict conformity with the directions and instructions of the manufacturer of the tapping sleeves and valves furnished.
- F. The Contractor shall submit details of proposed sleeve and valve for the Engineer's review. Sleeve and valve shall be as manufactured by Kennedy Valve Mfg. Co., Clow Corporation, Dresser Industries, Romac Industries, or equal.

### 3.10 JOINING PIPE OF DIFFERENT MATERIAL OR OUTSIDE DIAMETER

- A. Where specified or required, pipes of different material or outside diameter shall be joined with mechanical pipe couplings.
- B. Couplings shall be suitable for the intended service and shall be installed in accordance with the manufacturer's instructions.
- C. The Contractor shall submit details of proposed coupling for Engineer's review.
- D. Mechanical pipe couplings shall be Dresser Style 162 or equal.

### 3.11 CONTRACTOR RECORD KEEPING

- A. Measure and record the following:
  - 1. Service locations: Point of origin and terminus.
  - 2. Valve and fitting locations.
  - 3. Water main locations.

### 3.12 DISINFECTION

- A. The following water main shall be disinfected:
  - 1. New water main.
  - 2. Existing water main when cut into or repaired.
  - 3. Disinfect and flush system until samples test safe.

- B. Contractor will perform sampling and have an independent laboratory (certified by the Department of Natural Resources) perform bacteriological testing to certify that water is free of coliform bacteria. Supply engineer with copy of test results.

C. Tablet Method: AWWA C651

1. Place 5-gram calcium hypochlorite tablets each section of pipe as determined by the following table:

**Number of Tablets Per Section of Pipe**

<u>Pipe Diameter (inches)</u>	<u>Length of Pipe section (feet)</u>		
	<u>13 or less</u>	<u>18</u>	<u>20</u>
4	1	1	1
6	1	1	1
8	1	2	2
10	2	3	3
12	3	4	4
16	4	6	7

2. Place one tablet in each hydrant, hydrant lead, and other appurtenance.
3. Attach tablets with a food-grade adhesive to the top inside surface of the pipe:
- Adhesive shall be USDA for contact with edible products.
  - Adhesive shall be Permatex Form-A-Gasket No. 2, Permatex Clear RTV Silicone, or equal.
  - Permatex Form-A-Gasket No. 1 is not acceptable.
4. Fill main in a manner such that the water velocity within the main will not exceed 1 fps.
5. Water shall remain in pipe for a minimum of 24 hours, if water temperature is less than 40° F, it shall remain in pipe a minimum of 48 hours.
6. For pipe diameters larger than 16 inches, refer to AWWA C651 for correct calcium hypochlorite dosage.

**3.13 PIPE TESTING**

- A. Perform pipe testing in accordance with Section 01661, Testing and Inspection of Pipeline Construction.
- After disinfection testing has been completed.
  - Disinfect all testing equipment and fittings.

**PART 4 - MEASUREMENT AND PAYMENT**

A. Water main

- Measure water main along the centerline of the water main as installed, with no deductions for fittings and valves.
- The unit price per linear foot shall include:
  - Labor, material and equipment.
  - Clearing and grubbing.
  - Removal, hauling, and disposal of all street surfacing and curb and gutter in the trench area.
  - Excavation and dewatering.
  - Traffic control.
  - Erosion control.



- g. Installation of water main pipe materials, fittings, including pipe bedding and cover material.
- i. Poly-wrap fittings, valves, valve boxes, valve box hangars, hydrants and curb stops.
- j. Reaction blocking.
- k. Joint restraints.
- l. Backfilling and compacting.
- m. Loading, hauling and disposal of surplus excavated material.
- n. Dust control.
- o. Restore all facilities damaged or destroyed during construction.
- p. Landscaping.
- q. Maintenance and repair of all disturbed street surfacing.
- r. Leakage and pressure testing.
- s. Sterilize and flush the lines until a satisfactory test can be obtained from a certified laboratory.
- t. Provide bacteriological testing.
- u. Tracer wire.
- v. Tracer wire testing.

B. Valves

- 1. Measure valves on a per each unit price for each size and type installed.
- 2. Unit price per valve shall include:
  - a. Labor, material and equipment.
  - b. Valve box.
  - c. Valve box hangers.

C. Fire Hydrants

- 1. Measure hydrants on a per each unit price for each hydrant installed.
- 2. Unit price per hydrant shall include:
  - a. Labor, material, and equipment.
  - b. Excavation, dewatering, and backfilling.
  - c. Tie rods, restraint clamps, and reaction blocking.
  - d. Drainage stone.

D. Water Service Connection Sets

- 1. Measure water service connection sets on a per each unit price for each connection set installed, which includes:
  - a. Corporation stop, curb stop and curb box.
  - b. Tapping saddles.
- 2. Unit price per connection set shall include:
  - a. Labor, material, and equipment.
  - b. Tapping the water main.
  - c. Providing location marker at the curb stop.
- 3. Curb Box Extensions
  - a. Shall be paid for by the vertical foot installed (when ordered by Owner).
  - b. Shall include coupler.

E. Water Service

1. Measure water service on a direct line from the corporation stop to the curb stop with no allowances for loops or routing around obstacles.
2. Unit price per linear foot shall include:
  - a. Labor, material, and equipment.
  - b. Removal, hauling and disposal of all street surfacing, and curb and gutter in the trench area.
  - c. Excavation, dewatering, and backfilling.
  - d. Traffic, dust, and erosion control.
  - e. Restoration and landscaping.
  - f. Leakage and pressure testing.
  - g. Tracer wire where required.

F. Water Service (Tunnel)

1. Measure water service based on the actual amount of water service tunneled in place.
2. The unit price per linear foot shall include labor, material, and equipment.

G. Boring & Jacking Casing Pipe

1. Measurement for the casing pipe shall be made along the centerline of the casing pipe as installed.
2. Payment shall be made by the unit price per linear foot installed and include:
  - a. Labor, equipment, and material necessary to install the casing pipe.
  - b. Blocking and supports necessary to anchor the water pipe inside the casing pipe.
  - c. Placing a sand slurry, pea gravel, or fly ash slurry to completely fill the annular space between the casing and sewer pipe.
  - d. The water pipe placed inside of the casing.

- END OF SECTION -

## SECTION 02680

### GENERAL PROVISIONS FOR HORIZONTAL DIRECTIONAL DRILLING

#### **PART 1 – GENERAL**

##### 1.01 SUMMARY

###### A. Related Sections and Divisions:

1. Applicable provisions of the General Conditions shall govern the work in this section.
2. Section 01300, Submittals.
3. Section 01563, Erosion Control.
4. Section 02220, Trenching, Backfilling and Compaction.
5. Section 02565, Forcemain.
6. Section 02623, Polyethylene Pipe.
7. Section 02665, Water Main.
8. Section 02720, Storm Sewer.
9. Section 02730, Sanitary Sewer.

##### 1.02 SUBMITTALS

###### A. Submit shop drawings in accordance with Section 01300, Submittals.

###### B. Submit proposed construction operations and schedules to the Engineer minimum of 30 days prior to beginning work.

1. Details shall include types of equipment, construction procedures, material and equipment delivery schedules, type of drilling fluid, Viscosity, weight limits, bit pressures, method of disposal, destination of drilling fluids, and other pertinent information.

##### 1.03 QUALITY ASSURANCE

###### A. Horizontal directional drilling shall be in accordance with permits issued by the following:

1. U. S. Army Corps of Engineers
2. State of Wisconsin Department of Natural Resources.

#### **PART 2 – PRODUCTS**

##### 2.01 PIPING

**PROJECT MANAGER—SELECT PIPE TYPE.  
SEAMLESS PIPE IS REQUIRED FOR WISDOT PROJECTS.**

###### A. Piping shall be in accordance with Section 02623, Polyethylene Pipe OR Section 02622, PVC Plastic Pipe, Restrained Joint Pipe.

##### 2.02 DRILLING FLUIDS

###### A. Drilling fluids composition shall meet permit requirements and environmental regulations.

## 2.03 WATER

- A. Contractor shall procure, transport, and store water required for his operations.

## **PART 3 – EXECUTION**

### 3.01 GENERAL

- A. Directionally controlled horizontal drilling operation shall consist of drilling a small diameter pilot hole along alignment and at elevations indicated on Drawings; reaming a pilot hole to a diameter suitable for installation of prefabricated forcemain, sanitary sewer main, sanitary sewer lateral or water main; installing forcemain, sanitary sewermain, sanitary sewer lateral, or water main along reamed hole; and coordinating connections from the pull section to the forcemains or sanitary sewer lateral.
- B. Contractor shall at all times provide and maintain instrumentation which will accurately locate pilot hole position in X, Y, and Z axis relative to ground surface. Drilling fluid flow rate and pressure shall also be monitored. The Engineer shall have access to this data at all times during the operation.

### 3.02 PILOT HOLE—FORCEMAIN OR WATER MAIN

- A. A pilot hole shall be drilled along the path shown on Drawings to the following tolerances:
1. Elevation: Plus 0 feet, minus 1 foot
  2. Alignment: Plus or minus 1 foot
  3. Curve Radius: Minimum 250 feet or pipe manufacturer's recommendation, whichever is greater.
  4. Entry Point: At the location shown on Drawings.
  5. Exit Point: Pilot hole shall penetrate ground surface within plus or minus 1 foot of alignment shown on Drawings and within plus 10 feet and minus 10 feet of length shown on Drawings.

### 3.03 PILOT HOLE – SANITARY SEWERMAIN OR SANITARY SEWER LATERAL

- A. A pilot hole shall be drilled along the path shown on the drawings and to the tolerance to allow the pipe to be installed to the grades specified.

### 3.04 RECORD DOCUMENTS

- A. Contractor shall plot actual horizontal and vertical alignment of pilot bore at intervals not exceeding 50 feet.
1. This "as-built" plan and profile shall be updated as pilot bore is advanced.
  2. Submit five copies of the "as-built" plan and profile to the engineer within 10 days of pipeline completion.

### 3.05 RESTRICTIONS

- A. In all cases, right-of-way restrictions shall take precedence over the tolerances listed above.
- B. Regardless of the tolerance achieved, no pilot hole will be accepted if it will result in any or all of pipeline being installed in violation of right-of-way restrictions.

- C. In all cases, concern for adjacent utilities and structures shall take precedence over the tolerances listed above.
- D. Specification of tolerances does not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.
- E. After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates to the Engineer, referenced to drilling entry point, which accurately describes location of pilot hole.

### 3.06 SANITARY SEWERMAIN

#### A. General

1. The sewermain shall be constructed so the pipe has a uniform grade as shown on the plans.
2. Alignment shall be as shown on the plans.
3. Upon completion of the pipe installation, the Contractor shall run water in the sewermain from the upstream manhole until the water is present at the downstream manhole.
4. The sewermain shall then be televised and recorded in the presence of the engineer. Any standing water in excess of 1/2-inch will be cause for sewermain rejection.
5. Rejected sewermain shall be replaced at the contractor's expense.

### 3.07 SANITARY SEWER LATERALS

#### A. General

1. The lateral shall be constructed so the pipe has a uniform grade of 1/8-inch to 1/4-inch per foot.
2. Grade shall not exceed 1/2-inch per foot.
3. Horizontal alignment shall be plus or minus 2 feet.
4. Upon completion of the pipe installation and before the lateral is connected to the sanitary sewer main, the Contractor shall run water in the lateral until the water is present at the sewer main end of the lateral.
5. The lateral shall then be televised and recorded in the presence of the Engineer. Any standing water in excess of 1/2-inch will be cause for lateral rejection.
6. Rejected laterals shall be drilled at the contractor's expense.

- B. The Contractor shall obtain written permission from property owners for any drilling operations on private property. A copy of the written permission shall be submitted to the Engineer before starting the work.

- C. All laterals shall be excavated at the property line. Restoration on private property shall be completed within 1 week after the installation of the sanitary sewer lateral.

#### D. Pilot Hole

1. A pilot hole shall be drilled along the path of the sanitary sewer lateral as shown on the drawings or as directed by the Engineer.
2. Entry and exit points shall be determined by the Contractor as required to provide the required grade of the lateral from the sanitary sewer main to the property line.

### 3.08 REAMING AND PULL-BACK OPERATION

- A. Upon completion of pilot hole drilling, hole shall be enlarged by reaming and preassembled pipeline pull section shall be installed in hole.

1. Pipeline shall be preassembled to provide one continuous pulling operation.
  2. Pipeline shall be temporarily capped before pulling operation to prevent any drilling fluid, water, or debris from entering pipeline.
- B. Prereaming operations shall be conducted at discretion of Contractor.
1. All provisions of this specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.
- C. The maximum allowable tensile load imposed on pipeline pull section shall be calculated based on 70 percent of minimum yield strength (SMYS) of the pipe.
1. If more than one value is involved for a given pull section, the lesser value shall govern.
  2. Contractor shall maintain accurate records of pull forces at all times for review by the Engineer.
- D. A swivel shall be used to connect pipeline pull section to reaming assembly to minimize torsional stress imposed on section.
- E. Pull section shall be supported as it proceeds during pull-back so that it moves freely and pipe is not damaged.
- F. Pull section shall be installed in reamed hole in such a manner that external pressures are minimized.
1. Any damage to pipe resulting from external pressure during installation shall be the responsibility of Contractor.
- G. Buoyancy Modification:
1. Buoyancy modification shall be used at the discretion of Contractor.
  2. Any buoyancy modification procedure proposed for use shall be submitted to the Engineer for acceptance.
  3. No procedure may be used which has not been reviewed by the Engineer.
  4. Contractor will be responsible for any damage to the pipeline resulting from buoyancy modification.

### 3.09 DRILLING FLUIDS

- A. Contractor shall employ his best efforts to minimize excess drilling fluid by recirculating surface returns.
1. This shall include, but not be limited to, provision of a solids control system sized and configured to remove spoil from drilling fluid surface returns so that fluid may be returned to active system without hindering drilling progress.
- B. Disposal of excess drilling fluids and spoil shall be the responsibility of Contractor and shall be conducted in compliance with environmental regulations, right-of-way and workspace agreements, and permit requirements.
1. Drilling fluid and spoil disposal procedures proposed for use shall be submitted to the Engineer for acceptance.
  2. No procedure may be used which has not been reviewed by the Engineer.
- C. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids.
1. Drilling fluid returns at locations other than entry and exit points shall be minimized.
  2. In the event that annular circulation is lost, Contractor shall take steps to restore circulation.

3. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained with hand-placed barriers (hay bales, sandbags, silt fences, etc.), and collected using pumps, where practicable.
4. If amount of surface return is not great enough to be collected, affected area shall be flushed with fresh water and fluid shall be allowed to dry and dissipate naturally.
5. If amount of surface return exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used.
6. If amount of surface return exceeds that which can be contained and collected in small sumps, drilling operations shall be suspended until surface return volumes can be brought under control.

### 3.10 SAFETY AND RELATED MATTERS

- A. Comply with all federal, state, and local rules and regulations concerning:
  1. Construction safety.
  2. Noise control.
  3. Dust and smoke control.
- B. Access to Public Services
  1. Insure free access to all fire hydrants, valve boxes, manholes, curb stops, fire alarms, police call boxes.
- C. Protection of Work, Public and Property
  1. Provide safe passage for local traffic, pedestrian and vehicular.
  2. Provide access to properties where work is being performed.
  3. Provide all necessary barricades, warning lights, and signs, signals, flagmen, etc. in accordance with federal, state, and local regulations.
  4. Obtain and comply with required permits.
  5. Machinery, equipment, and hazards shall be guarded in accordance with federal, state or local regulations.
  6. Excavations and trenching shall be made in accordance with safety practices formulated and enforced by federal, state, and local regulations.
  7. Notify police or sheriffs department and fire department before blocking off street, highway, alley or public thoroughfare.

### 3.11 EXISTING UTILITIES AND STRUCTURES

- A. When existing utilities and structures are indicated on drawings, it should not be assumed that all existing utilities and structures are shown.
  1. The location of existing utilities and structures when given are plotted on the drawings for information to the Contractor, but is not to be construed as a representation of the actual location.
  2. Contractor shall be responsible for injuries and damage to any structures, facilities, utilities, and public or private property resulting from construction.

### 3.12 NOTICE FOR STAKING

- A. Notify Engineer at least three working days in advance of the time when staking will be required.

### 3.13 PROTECTION OF ESTABLISHED PROPERTY MARKERS

- A. Protect all property markers (iron pipe, concrete or wood posts, etc.) from movement from original position.
- B. Cost of replacement of property markers moved during construction shall be at Contractor's expense.

### 3.14 CLEANING OF PROJECT SITE

- A. Work Site
  - 1. Keep the site of the work including all private or public property involved in or adjacent to the work, free from any rubbish, surplus or waste materials deposited or which have accumulated as a result of the work.
  - 2. Remove all materials, tools, and equipment leaving the site of the work clean, unobstructed and ready for use.

## **PART 4 – MEASUREMENT AND PAYMENT**

### 4.01 HORIZONTAL DIRECTIONAL DRILLING

- A. Measurement shall be made horizontally along the centerlines of the pipeline actually installed.
- B. Payment shall be made by the unit price per linear foot and include:
  - 1. Pipe material, equipment, and labor.
  - 2. Clearing and grubbing.
  - 3. Stripping and stockpiling topsoil.
  - 4. Traffic, dust, and erosion control.
  - 5. Loading, hauling and disposal of street surfacing and curb & gutter in work area.
  - 6. Dewatering and excavation.
  - 7. Disposal of all excess drilling fluids.
  - 8. Loading, hauling and disposal of surplus excavated material.
  - 9. Backfilling and compaction.
  - 10. Water.
  - 11. End caps (sewer laterals).
  - 12. Location markers (sewer laterals).
  - 13. Complete restoration and landscaping.
  - 14. Repair and maintenance of disturbed street surfaces.
  - 15. Quality control testing.

- END OF SECTION -



## SECTION 02720

### STORM SEWER AND DRAINAGE

#### **PART 1 - GENERAL**

##### 1.01 SUMMARY

- A. Work Included: This section includes storm sewer installation, materials and restoration.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 01563, Erosion Control
  - 4. Section 01661, Testing and Inspection of Pipeline Construction.
  - 5. Section 02220, Trenching, Backfilling and Compaction.
  - 6. Section 02290, Soils and Aggregates.
  - 7. Section 02600, Buried Piping and Appurtenances.
  - 8. Section 02622, PVC Plastic Pipe.
  - 9. Section 02936, Landscaping.

##### 1.02 REFERENCE STANDARDS

- A. ASTM: American Society for Testing and Materials
- B. AASHTO: American Association of State Highway and Transportation Officials

##### 1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01300, Submittals including the following:
  - 1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
  - 2. One copy of all test reports.

#### **PART 2 - PRODUCTS**

##### 2.01 PIPE MATERIAL

- A. PVC Sewer Main
  - 1. Sizes 8" through 15": ASTM D3034, SDR 35.
  - 2. Sizes 18" through 27": ASTM F679.
  - 3. Joints: Elastomeric conforming with ASTM D3212.
- B. PVC Sewer Service
  - 1. Conform with ASTM D1784 and D1785.
  - 2. Sizes 6": Schedule 40.
  - 3. Joints: Solvent weld conforming to ASTM D2855.
- C. Concrete Reinforced Pipe Sewer Main
  - 1. Conform to ASTM C76.

2. Use "C" wall.
3. Joints: Bell and spigot conforming to ASTM C443 with rubber O-ring or rubber profile gaskets.
4. Provide Inserta Tee, Kor-N-Tee or equal for lateral connections.

D. Flared End Sections

1. Conform with ASTM C76.

2.02 MANHOLES

A. Precast Manholes

1. Conform with ASTM C478 for precast components.
2. Joints: Conform with ASTM C443.
3. Gasket: 1¼-inch by 1¼-inch thick butyl preformed tape conforming with AASHTO M198 for barrel sections.

B. 3/8-inch x 1/2-inch butyl preformed tape conforming with AASHTO M198 for adjusting rings.

C. Cast-In-Place Manholes

1. Conform with drawing details.
2. Use only where called for on drawings.

D. Manhole Steps

1. ½-inch diameter grade 60 steel reinforcement rod encapsulated in copolymer polypropylene.
2. As manufactured by M.A. Industries, Inc., or equal.

E. Castings

1. Conform to ASTM A48, Class 35.
2. Manhole castings
  - a. Use Neenah R-1500 or equal.
  - b. Lid shall be non-rocking with open pick holes.

F. Manhole components shall be suitable for AASHTO H-20 loadings.

G. Sewer Joint Compound

1. Sewer joint compound shall be as manufactured by Pure Asphalt Company or equal.

2.03 INLETS

A. Precast Components: Conform with ASTM C478.

B. Joints: Mortar conforming to ASTM C91, Type M.

C. Castings

1. Conform to ASTM A48, Class 35
2. Inlet grates shall be bicycle safe.
3. Provide inlet castings as follows:
  - a. 2'x3' rectangular: Neenah R-3246, or R3067, or equal with Type L grate.

- b. 30" interior diameter round, with curb & gutter: Neenah R3075, or equal with type L grate. (At driveway openings, use Neenah NF 10996 grate).
- c. 30" interior diameter round, without curb & gutter: Neenah R2500 or equal.
- d. 30" interior diameter round with mountable curb & gutter: Neenah R3501-L1A
- e. Yard inlet: Neenah R4360-D or equal.
- f. Manhole inlets: Neenah R-3275 or equal with Type A grate, or R3246A, or R3067, or equal with Type L grate.

D. Inlet components shall be suitable for AASHTO H-20 loadings.

E. Underdrain

- 1. Drainage pipe, Corrugated polyethylene tubing, AASHTO designation M252.
- 2. Tubing sock
  - a. Fabric: Knitted polyester
  - b. Mullen burst: 100 (lbs./ft<sup>2</sup>)
  - c. Water flow rate: 350 (gpm/min/ft<sup>2</sup> at 3-inch head)
- 3. Filter fabric (stone wrap)
  - a. Fabric: Knitted, woven or non-woven fibers of polyester, polypropylene, stabilized nylons, polyethylene or polyvinylidene chloride (slit film woven fabrics shall not be used)
  - b. Mullen burst: 60 min (lbs/in<sup>2</sup>) (Method ASTM D3786)
  - c. Water flow rate: 100 min (gal/min/ft<sup>2</sup> at 50 mm constant head) (Method 2)
  - d. Grab tensile strength: 35 min (Method ASTM D4632)
  - e. Equivalent opening size: 30-140 (Method Corps of Engineers CW-02215-77)
  - f. Drainage pipe bedding and pipe cover: ASTM D448 - No. 67

## 2.04 FILTER FABRIC

A. Conform with the following minimums:

- 1. Weight: 6 Oz./SY
- 2. Thickness: 100 mils
- 3. Grab strength/elongation: 175 Lbs./50%
- 4. Puncture strength/burst strength: 95 Lbs./375 psi
- 5. Permeability: 0.4 cm/sec.

## 2.05 RIPRAP

A. As shown on plans and in accordance with Section 02290, Soils and Aggregates.

## 2.06 PIPE BEDDING

- A. Pipe bedding shall be soil class A-7 compacted to 95% of Modified Proctor.
- B. Loss due to sulfate soundness test shall not exceed 10%.
- C. Loss due to abrasion test shall not exceed 40%.

## **PART 3 - EXECUTION**

### **3.01 SEWER MAIN INSTALLATION**

#### **A. Pipe Installation**

1. Pipe installation shall conform with Section 02220, Trenching, Backfilling and Compacting.
  - a. Lay pipe upgrade with spigot pointing in direction of flow.
  - b. Pipe bedding and backfilling shall conform with the standard details as shown on the drawings.

#### **B. Grade and alignment shall be established with laser equipment.**

1. Sewers shall be laid with straight alignment between manholes.
2. Slope between manholes shall be uniform with no ponding water.
3. Laser alignment shall be checked a minimum of every 100 feet.

#### **C. Water/Sewer Line Crossing**

1. Wherever the storm sewer crosses above watermain with less than a clear vertical separation of 18 inches (outside of pipe to outside of pipe) or below the watermain with less than a clear vertical separation of 6 inches (outside of pipe to outside of pipe), the sewer shall be constructed equal to watermain pipe. One full pipe length shall be centered on the watermain crossing.
2. The type of pipe material and/or joints shall not change between manholes.

### **3.02 SERVICE CONNECTIONS**

#### **A. Unless indicated otherwise, terminate services at the property line.**

#### **B. Services shall conform with all plumbing codes for depths and installation. Service depth shall be sufficient to accommodate the lowest service point.**

#### **C. When a service is not immediately connected:**

1. Mark in accordance with details. The Contractor shall record the location, length and depth for record drawings.
2. Provide a watertight cap on end of service.

#### **D. Install wye or tee branches where directed.**

1. New sewers: Utilize a factory made wye or tee.
2. Existing sewers: Utilize a saddle type wye or tee.
3. Wyes or tees connected to concrete pipe shall be core drilled and installed with a flexible watertight connector which can be mechanically expanded into the cored opening.

### **3.03 MANHOLES**

#### **A. Installation**

1. Place manholes on a minimum of 6 inches soil class A-7, compacted to 95% Modified Proctor Density.
2. Establish flow line and rim elevations from grade stake provided.
3. Furnish manholes in 4-foot diameter (standard diameter) when dimensions are not shown.
4. Manholes shall be precast construction, unless shown otherwise.

5. Provide manhole riser sections in a combination of lengths which will minimize the number of joints.
6. Seal manhole joints with 1¼-inch Butyl-Lok preformed tape or equal.
7. Set casting frames and adjusting rings on preformed tape.
  - a. Pitch castings to match street crowns.
8. Manhole casting shall be centered, brought to grade and embedded in two rows of ⅜-inch x ½-inch Kent Seal, or equal. A minimum of two 21-inch concrete adjusting rings shall be used between the manhole frame and core. Two rows of ⅜-inch x ½-inch Kent Seal shall be used between the manhole rings. Coat outside of adjusting rings only with sewer joint compound per manufacturer's instructions. Maximum height of adjusting rings shall be 12 inches.
9. Pipe shall enter manholes through a flexible, watertight gasket or connector manufactured in accordance with ASTM C443 or C923.
  - a. Whenever practical, pipe opening shall be factory made using A-Lok or equal.
10. The following shall be filled with mortar and finished smooth:
  - a. Lift holes
  - b. Annular space around pipes: Interior bottom half only.

**B. Inverts**

1. Furnish precast manholes with shop manufactured inverts.
2. Shape and slope flowline of invert to match largest connecting pipe.
3. Slope invert bench upward to manhole wall.

**C. Flared End Sections**

1. Flared end sections shall be installed with splash pads constructed of riprap placed on filter fabric.
2. If a dimension is not shown on the drawings, the splash pad shall be a minimum of 10'x 10'.
3. End section restraints (where shown on the plans).
  - a. End sections shall be; anchored with two (2) three-quarter (¾) inch rods and three-quarter (¾) inch eye bolts.
  - b. End sections shall be anchored to the second pipe back.

- D. Contractor shall furnish the Owner two (2) manhole cover removing tools per contract.**

**3.04 INLETS**

**A. Installation**

1. Place inlets on a minimum of six inches of soil class A-7, compacted to 95% Modified Proctor Density.
2. Establish line and grade from grade stakes provided.
3. Minimum inlet height from top of base to top of curb shall be four feet.
4. Provide type of inlet as shown on the plans.
5. Provide underdrains where shown on plans.
6. Underdrains shall be polyethylene tubing encased in a geo-textile sock and installed as follows:
  - a. Embed tubing in clean stone and wrap stone with filter so that no water can enter the stone without passing through the fabric.
  - b. Fabric shall not be exposed to direct sunlight more than 24 hours.
  - c. Dead ends of the tubing shall be tightly capped.

- d. Discharge ends of tubing shall enter the inlet through a tight fitting penetration which was core-drilled or casted in the inlet wall.

### 3.05 FIELD QUALITY CONTROL

- A. Pipe testing shall be in accordance with Section 01661, Testing and Inspection of Pipeline Construction.

## **PART 4 - MEASUREMENT AND PAYMENT**

### A. Storm Sewer

- 1. Measurement shall be made along the centerlines of the pipeline actually installed with no deductions for manholes.
- 2. Payment shall be made by the unit price per linear foot and include:
  - a. Pipe material, equipment and labor.
  - b. Clearing and grubbing.
  - c. Stripping and stockpiling topsoil.
  - d. Traffic, dust and erosion control.
  - e. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
  - f. Dewatering and excavation.
  - 9. Pipe bedding and initial cover material.
  - h. Loading, hauling and disposal of surplus excavated material.
  - i. Backfilling and compaction
  - j. End caps (sewer services).
  - k. Location markers (sewer services).
  - l. Complete restoration and landscaping.
  - m. Repair and maintenance of disturbed street surfaces.
  - n. Field quality control.

### B. Sewer Service Lateral

- 1. Measurement shall be based on each lateral installed.
- 2. Payment shall be made at the unit price per each and include:
  - a. Labor and material.
  - b. Adaptors if needed.
- 3. Service taps (in manholes and inlets)
  - a. Taps shall be incidental to sewer service laterals.
    - 1) Labor and material.
    - 2) Core drilling pipe, manholes or inlets
    - 3) Flexible watertight connector with adaptor

### C. Manholes

- 1. Measurement shall be made from the lowest pipe invert to the rim as installed.
- 2. Payment shall be made by the unit price per vertical foot installed and include:
  - a. Dewatering and excavation.
  - b. All pre-cast components, steps and frame and cover.
  - c. Gasketed pipe openings and joint seals.
  - d. Adjusting rings and sewer joint compound.
  - e. Sump depth as shown on plans.
  - F. Chimney seals.

D. Inlets

1. Measurement shall be based on each inlet installed.
2. Payment shall be made at the unit price per each and include:
  - a. Dewatering and excavation.
  - b. Pre-cast components, frame and grate.
3. Payment for inlets with underdrains shall be made at the unit price per each and include:
  - a. Dewatering and excavation.
  - b. Pre-cast components, frame and grate.
  - c. Drain tubing with:
    - 1) Sock filter.
    - 2) Granular bedding and cover.
    - 3) Filter fabric wrapped around granular bedding and backfill.
    - 4) Tubing and caps.
  - d. Sump depth as shown on plans.
4. Chimney seals.

E. Inlet Lead

1. Measurement shall be made along the centerlines of the lead from center of structure to center of structure.
2. Payment shall be made at the unit price per linear foot and include:
  - a. Pipe material, equipment and labor.
  - b. Traffic, dust and erosion control.
  - c. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
  - d. Loading, hauling and disposal of surplus excavated material.
  - e. Dewatering and excavation.
  - f. Pipe bedding and initial cover material.
  - g. Backfilling and compaction.
  - h. Repair and maintenance of disturbed street surfaces.
3. Perforated inlet lead shall be subject to the above and additionally include:
  - a. Pipe perforations.
  - b. Filter fabric wrap.
  - c. Stone backfill to the road base course.

F. Flared End Sections

1. Measurement shall be based on each end section installed.
2. Payment shall be made at the unit price per each and include:
  - a. Labor and material.
  - b. Riprap and filter fabric.
  - c. Restraint rods.

- END OF SECTION -

## SECTION 02721

### CORRUGATED METAL CULVERT PIPE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Work Included: This section includes furnishing and installing corrugated metal pipe and fittings.
- B. Size of pipe, gage, fittings, and coatings required shall be as shown on the drawings.

##### 1.02 REFERENCE STANDARDS

- A. Standards listed in this section refer to latest revision.
- B. American Society for Testing and Materials (ASTM)
  - 1. A760 – Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drawing.
- C. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. M36 – Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Draws.

##### 1.03 QUALITY ASSURANCE

- A. Inspections
  - 1. Inspections shall be made to reject pipe that fails to conform to these specifications.
  - 2. Pipe and fittings shall be inspected by the Contractor before use.
  - 3. Pipe and fittings shall be available for inspection by Engineer at place of manufacture, jobsite, or any other point of delivery.
- B. Pipe shall be rejected for any of the following:
  - 1. Uneven laps.
  - 2. Variation from a straight centerline of more than ½ inch.
  - 3. Ragged or diagonal sheared edges.
  - 4. Loose bolts or rivets.
  - 5. Fasteners which are unevenly lined.
  - 6. Poorly formed seams.
  - 7. Illegible brand marking.
  - 8. Poorly formed seams
  - 9. Dents or bends in the metal.
  - 10. Elliptical shape on round pipe.
    - a. The average inside diameter of the pipe shall not vary more than ½ inch or 1 percent, whichever is greater. Measurement shall be on the inside crest of the corrugations.
- C. Replace all rejected pipe.
- D. Rejected pipe shall be clearly marked “REJECTED” with OSHA yellow paint.



## 1.04 PRODUCT DELIVERY

### A. Marking

The following shall be painted on each piece of pipe:

1. Manufacturer's name or trademark.
2. Date of manufacture.
3. Pipe size.

### B. Shipping

1. Pipe and fittings shall be packaged to prevent damage during shipping.
2. Fittings shall be on pallets.
3. All loading or unloading shall be done with lifts to avoid shock.
4. No materials shall be dropped.

### C. Storage

1. Provide safe storage for material.
2. Interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter.
3. Fittings shall be stored in a manner that will allow them to drain and protect them from freezing.

## 1.05 SUBMITTALS

### A. Submit the following in accordance with Section 01300, Submittals:

1. Shop drawings for sectional plate pipe, sectional plate arches, or sectional plate pipe arches consisting of shop details, erection, and other working plans showing dimensions, sizes of material fittings, details, and other information necessary for the complete fabrication and erection of the metal work.
2. A certificate setting forth the name or brand of metal to be furnished and a typical or average analysis showing the percent of carbon, manganese, phosphorus, sulfur, silicon, copper, and any other elements specified for the particular kind of base metal.

## **PART 2 - PRODUCTS**

## 2.01 MANUFACTURE

- A. All pipe, fittings, and joints shall be manufactured per Standard M36.
- B. Unless otherwise specified, dimensions, sheet thickness and minimum sheet gage for galvanized steel round pipe shall be as follows:

**CORRUGATED METAL PIPE**  
**DIMENSIONS AND GAGES**

Nominal Size (Inches)	Minimum Gage Number	Sheet Thickness (Inches)	Area-Square Feet
6	18	0.052	0.20
8	16	0.064	0.35
10	16	0.064	0.55
12	16	0.064	0.79
15	16	0.064	1.23
18	16	0.064	1.77
21	16	0.064	2.41
24	16	0.064	3.14
30	14	0.079	4.91
36	14	0.079	7.07
42	12	0.109	9.62
48	12	0.109	12.57
54	12	0.109	15.90
60	10	0.138	19.64

- C. Unless otherwise specified, dimensions, sheet thickness, and minimum sheet gage for galvanized steel arch pipe shall be as follows:

**CORRUGATED METAL PIPE**  
**ARCH DIMENSIONS AND GAGES**

Pipe Arch Size (Inches)	Equivalent Diameter (Inch)	Span (Inch)	Rise (Inch)	Minimum Gage No.	Sheet Thickness (Inch)	Area-Square Feet
14x19	12	14	9	16	0.064	-
17x13	15	17	13	16	0.064	1.1
21x15	18	21	15	16	0.064	1.5
24x18	21	24	18	16	0.064	2.2
28x20	24	28	20	14	0.079	2.8
35x24	30	35	24	14	0.079	4.4
42x29	36	42	29	12	0.109	6.4
49x33	42	49	33	12	0.109	8.7
57x38	48	57	38	12	0.109	11.4
64x43	54	64	43	12	0.109	14.3
71x47	60	71	47	10	0.138	17.6

- D. Unless otherwise specified, dimensions, sheet thickness and minimum sheet gages for aluminum coated (type 2) round pipe shall be as follows:

**CORRUGATED ALUMINUM COATED (TYPE 2) PIPE**  
**DIMENSIONS AND GAGES**

Nominal Size (Inches)	Minimum Gage Number	Sheet Thickness (Inches)	Area-Square Feet
6	18	0.048	0.20
8	16	0.060	0.35
10	16	0.060	0.55
12	16	0.060	0.79
15	16	0.060	1.23
18	16	0.060	1.77
21	16	0.060	2.41
24	14	0.075	3.14
30	14	0.075	4.91
36	12	0.105	7.07
42	12	0.105	9.62
48	12	0.105	12.57
54	12	0.105	15.90
60	8	0.167	19.64

- E. Unless otherwise specified dimensions, sheet thickness and minimum sheet gage for aluminum coated (type 2) arch pipe shall be as follows:

**CORRUGATED ALUMINUM COATED (TYPE 2) PIPE**  
**ARCH DIMENSIONS AND GAGES**

Pipe Arch Size (Inches)	Equivalent Diameter (Inch)	Span (Inch)	Rise (Inch)	Minimum Gage No.	Sheet Thickness (Inch)	Area-Square Feet
17x13	15	17	13	16	0.060	1.1
21x15	18	21	15	16	0.060	1.5
24x18	21	24	18	16	0.060	2.2
28x20	24	28	20	14	0.075	2.8
35x24	30	35	24	14	0.075	4.4
42x29	36	42	29	12	0.105	6.4
49x33	42	49	33	12	0.105	8.7
57x38	48	57	38	12	0.105	11.4
64x43	54	64	43	12	0.105	14.3
71x47	60	71	47	10	0.167	17.6

## 2.02 MATERIALS

### A. Culverts and Underdrain

1. Materials shall meet Standard M218.
2. All rivets, bolts, and nuts shall be hot dip galvanized.
3. All rivets shall conform to Standard A31 Grade A.
4. Pipe Seams:

- a. Bolts shall conform to Standard A449.
  - b. Nuts shall conform to Standard A563 Grade C.
- 5. Connecting band bolts shall conform to Standard A307 Grade A.
- B. Field Assembled Structures
  - 1. Materials shall meet Standard M167.
  - 2. Bolts shall meet Standard M164.
- C. Couplers
  - 1. Couplers shall be made of the same material as the pipe.
  - 2. Coupler thickness shall not be less than 0.052 inch nor more than 0.109 inch.
  - 3. The coupler corrugations shall mesh with the pipe corrugations.
  - 4. Coupler width shall be:
    - a. Greater than 7 inches for 30-inch diameter and smaller.
    - b. Greater than 12 inches for 36-inch to 96-inch diameter.
    - c. Greater than 24 inches for 102-inch to 120-inch diameter.
- D. Fittings shall be manufactured to the standard dimensions shown in Figures 38 and 39 of the Installation Manual of the National Corrugated Steel Pipe Association.
- E. Coatings
  - 1. Bituminous coating, (when shown on plans) shall be applied per Standard M190.
  - 2. Polymeric coatings, (when shown on plans) shall be applied per Standards M245 and M246.

### **PART 3 - EXECUTION**

#### **301 INSTALLATION**

- A. Installation shall be made per the recommendations of the Installation Manual for Corrugated Steel Drainage Structures of the National Corrugated Steel Pipe Association.
- B. Bedding and backfilling shall be performed in accordance with Section 02220, "Trenching, Backfilling and Compacting."

#### **3.02 COATINGS**

- A. Field applied coatings shall meet Standard M243.
- B. Where the spelter coating has been damaged by cutting or welding, the damaged area shall be wire brushed and painted with two coats of zinc dust-zinc oxide paint.

- END OF SECTION -

## SECTION 02730

### SANITARY SEWER

#### **PART 1 - GENERAL**

##### 1.01 DESCRIPTION

- A. Work Included: This section shall include furnishing all materials for the sanitary sewer work as shown on the drawings and as specified herein.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 01563, Erosion Control.
  - 4. Section 01661, Testing and Inspection of Pipeline Construction.
  - 5. Section 02220, Trenching, Backfilling and Compaction.
  - 6. Section 02290, Soils and Aggregates
  - 7. Section 02600, Buried Piping and Appurtenances.
  - 8. Section 02616, Ductile Iron Pipe.
  - 9. Section 02622, PVC Plastic Pipe.
  - 10. Section 02720, Storm Sewerage and Drainage.
  - 11. Section 02936, Landscaping.

##### 1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM), Current Annual Book of Standards.
- B. American Association of State Highway and Transportation Officials (AASHTO).

##### 1.03 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01300, Submittals including:
  - 1. Product literature and catalog cut sheets of materials to be supplied that relate to these specifications.
  - 2. One copy of all test reports.

##### 1.04 PROTECTION OF PROPERTY MARKERS

- A. Contractor shall protect all property marker from movement from original position.
- B. Cost of replacement of property markers during construction shall be at the contractor's expense.

#### **PART 2 - PRODUCTS**

##### 2.01 PIPE MATERIAL

- A. PVC Sewer pipe shall be in accordance with Section 02622, PVC Plastic Pipe.
- B. Ductile iron pipe shall be in accordance with Section 02616, Ductile Iron Pipe.

- C. Concrete Reinforced Pipe shall be in accordance with Section 02720, Storm Sewerage and Drainage.
- D. Polyethylene pipe shall be in accordance with Section 02623, Polyethylene Pipe.

## 2.02 MANHOLES

### A. Precast Manholes

- 1. Manholes and drop manholes shall conform with ASTM C478 for precast components.
- 2. Base section shall have a 6-inch minimum thick integral floor slab with 4-inch thickness for walls and riser sections. Base section shall be cast monolithically.
- 3. Joints shall conform with ASTM C443.
- 3. Gasket shall be 1¼ -inch thick butyl conforming with AASHTO M198.
- 4. Manhole top shall be pre-cast eccentric cone.

### B. Cast-In-Place Manholes

- 1. Conform with drawing details.
- 2. Use only where called for on drawings.

### C. Pipe Seals

- 1. Seals shall be flexible, watertight gasketed for pipe entrance holes.
- 2. Acceptable manufacturers shall be A-Lok Products or equal.

### D. Manhole Steps

- 1. Manhole shall be a ½-inch diameter grade 60 steel reinforcement rod encapsulated in copolymer polypropylene.
- 2. Steps shall be as manufactured by M.A. Industries, Inc., or equal.

### E. Castings

- 1. Castings shall conform to ASTM A48, Class 35.
- 2. Shall be AASHTO H-20 rated.
- 3. Lid shall be a non-rocking with concealed pick holes and self-seal neoprene "T" gasket.
- 4. Use Neenah R-1500 or equal.
- 5. Use Neenah R-1916C or equal when watertight castings where shown on the plans.

### F. Sewer Joint Compound

- 1. Sewer joint compound shall be as manufactured by Pure Asphalt Company or equal.

### G. Frame and Chimney Seals

- 1. Seals shall be a flexible internal/external rubber seal and shall be provided where shown on the plans.
- 2. Rubber seal sleeve shall seal from the manhole frame to manhole cone section.
- 3. Rubber seal shall conform with ASTM D 412, D 2240, D 295, D 750, G 23, D 624 and D 297.
- 4. Butyl tape shall conform with ASTM D 792, C 771, C 765 and C 907.
- 5. Stainless steel band and clamp shall be type 304 stainless steel.
- 6. Acceptable manufacturers shall be Adaptor, Inc., or equal.

## 2.03 CLEAN-OUTS

- A. Light duty: In earth or grass foot-traffic areas use Adjust-A-Serve Sleeve as manufactured by American Infrastructure Technologies or equal.
- B. Heavy Duty: In vehicle traffic areas use top loading rated heavy duty, ASME A112.36.2M, round, cast-iron housing with clamping device and round secured, scoriated cast-iron cover. Include cast-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
- C. Frost sleeve shall be same material as specified for sanitary sewer piping.

## 2.04 WYES, RISERS, AND FITTINGS

- A. Shall be the same type and class as the sewer service pipe.

## 2.05 INSULATION BOARD

- A. Extruded polystyrene conforming with ASTM C578.
- B. Insulation shall be a minimum 1-inch thick.
- C. Provide where required by plans.

## 2.06 PIPE BEDDING AND BACKFILLING

- A. Pipe bedding and haunch shall be compacted to a minimum of 90% of modified proctor to the springline of the pipe prior to placement of initial backfill.
- B. Subsequent backfilling shall be in accordance with the standard details in the drawings and conform with Section 02220, Trenching, Backfilling, and Compacting.

# **PART 3 - EXECUTION**

## 3.01 SEWER MAIN INSTALLATION

- A. Pipe Installation
  - 1. Lay pipe upgrade with spigot pointing in direction of flow.
  - 2. When any portion of a section of sewer between manholes has a bury depth equal to or greater than 25 feet, SDR-26 pipe shall be installed.
  - 3. When the entire section of sewer between manholes is less than 25 feet of bury depth, SDR-35 may be installed.
- B. Grade and alignment shall be established with laser equipment.
  - 1. Sewers shall be laid with straight alignment between manholes.
  - 2. Slope between manholes shall be uniform with no ponding water.
  - 3. Laser alignment shall be checked a minimum of every 100 feet.
- C. Water/Sewer Line Crossing

1. Wherever the sanitary sewer crosses above watermain with less than a clear vertical separation of 18 inches (outside of pipe to outside of pipe) or below the watermain with less than a clear vertical separation of 6 inches (outside of pipe to outside of pipe), the sewer shall be constructed equal to watermain pipe. One full pipe length shall be centered on the watermain crossing and shall be pressure tested.
2. The type of pipe material and/or joints shall not change between manholes.

D. Maintaining Sanitary Sewer Service

1. The Contractor shall provide adequate equipment and facilities to provide bypass pumping for all elements of work requiring interruption to flow in the sanitary sewer. Provide backup or standby capabilities satisfactory to the Owner. The Contractor shall be responsible for damages to private or public property due to sewer backup while controlling sewage flow.
2. Under no circumstances will bypassing of untreated wastewater to any storm drainage facility or surface water course be allowed.
3. The Contractor shall notify the Owner and Engineer seven (7) days in advance of sewer sections, which will not be useable in order to allow time for the Owner to notify residents. Interruptions shall then be verified at least 24 hours in advance.
4. Interruptions of service shall be limited to eight (8) hours.
5. All existing sanitary laterals shall be permanently reconnected within two days after initial disconnection of the main line sewer bypass. These existing sanitary laterals shall be temporarily reconnected if the permanent reconnection cannot be accomplished immediately after disconnection.
6. All costs for flow control, temporary pumping, etc., shall be inclusive to the unit price bid for sanitary sewer.
7. All costs associated with connecting proposed sewers to existing sewers or manholes, manhole removal and abandonment, sanitary sewer removals and abandonment, shall, be included in the unit price bid for sanitary sewer.

3.02 SERVICE CONNECTIONS

- A. Unless indicated otherwise, terminate services at the property line.
- B. Services shall conform with all plumbing codes for depths and installation. Service depth shall be twelve (12) feet deep at the property line, or as deep as sewer main allows, or as shown on plans.
- C. Clean-outs required by the plumbing code or ordinances shall be incidental to the service installation.
- D. When a service is not immediately connected.
  1. Mark in accordance with details. The Contractor shall record the location, length and depth for record drawings.
  2. Provide a watertight cap on end of service.
- E. Install wye branches where directed
  1. New sewers: Utilize a factory made wye.
  2. Existing sewers- Utilize a saddle type wye.
  3. Wyes connected to concrete pipe shall be core drilled and installed with a flexible watertight connector, which can be mechanically expanded into the cored opening.



4. Wyres shall be oriented at a ten (10) or two (2) o'clock position from the main.

F. Riser Installation

1. Install where requested by Owner's Representative.
2. Conform with appropriate details.
3. Bends shall be 45°.
4. Place risers on a minimum of 6-inches of Soil Class A-7 compacted to 95% Modified Proctor Density.
5. Risers shall be installed at maximum 45° from horizontal. (standard service lateral or deep service lateral).
6. Risers shall be installed at maximum 67.5° from horizontal (optional deep service lateral).

3.03 MANHOLES

A. Installation

1. Place manholes on a minimum of 6 inches of Soil Class A-7 compacted to 95% Modified Proctor Density.
2. Establish flow line and rim elevations from grade stake provided.
3. Furnish 4-foot diameter manholes (standard diameter) when dimensions are not shown on the plans.
4. Manholes shall be precast construction, unless shown otherwise.
5. Provide manhole riser sections in a combination of lengths, which will minimize the number of joints.
6. Seal manhole joints with 1¼-inch Butyl-Lok preformed tape or equal, conforming the AASHTO M-198.
7. Adjusting rings:
  - a. Manhole casting shall be centered, brought to grade and embedded in two rows of 3/8-inch x ½-inch Kent Seal, or equal.
  - b. A minimum of 4 inches of adjusting rings shall be used between the manhole frame and casting.
  - c. All adjusting rings less than four inches shall be rubber. Two-inch concrete adjusting rings are not allowed.
  - d. For manholes located in roadways, the upper two inches shall be rubber adjusting rings.
  - e. For manholes located in traffic lanes, use tapered rubber adjusting rings.
  - f. Maximum height of adjusting rings shall be 12 inches.
  - g. Coat outside of adjusting rings only with sewer joint compound per manufacturer's instructions.
  - h. When watertight castings are shown on the plans, casting shall be anchored to the manhole structure.
8. Pipe shall enter manholes through a flexible, watertight gasket or connector manufactured in accordance with ASTM C443 or C923.
  - a. Whenever practical, pipe opening shall be factory made using A-Lok or equal.
9. The following shall be filled with mortar and finished smooth
  - a. Lift holes.
  - b. Annular space around pipes: Interior bottom half only.
10. Install chimney seals on all sanitary manholes in accordance with manufacturer's instructions.

B. Inverts

1. Furnish precast manholes with shop manufactured inverts
2. Shape and slope flow line of invert to match largest connecting pipe.
3. Slope invert bench upward to manhole wall.

C. Precast Drop Manholes

1. Coat outside of adjusting rings only with sewer joint compound per manufacturer's instructions.
2. Furnish where shown on plans and conform with plan details.

3.04 CLEAN-OUTS

- A. Install clean-outs and riser from sanitary sewer pipe to clean-out at grade. Install piping so clean-outs open in direction of flow.
- B. Set clean-outs frames and covers in unpaved areas flush with finished grade.
- C. Set clean-outs frames and covers in paving with tops flush with surface paving.
- D. Set clean-out frames and covers in pavement in a cast-in-place concrete block, 18-inch x 18-inch x 12-inch deep. Slope top of concrete away from clean-out.

3.05 PIPE TESTING

- A. Pipe testing shall be in accordance with Section 01661, Testing and Inspection of Pipeline Construction.

3.06 REPAIRS

- A. Contractor shall repair all visible leaks, defects, and pipeline, which have failed testing.
- B. After repairs are made, re-test and re-televiser repaired sections.

**PART 4 - MEASUREMENT AND PAYMENT**

4.01 SANITARY SEWER

- A. Measurement shall be made horizontally along the centerlines of the pipeline actually installed with no deductions for manholes.
- B. Payment shall be made by the unit price per linear foot and include:
  1. Pipe material, equipment, and labor.
  2. Clearing and grubbing.
  3. Stripping and stockpiling topsoil.
  4. Traffic, dust and erosion control.
  5. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
  6. Dewatering and excavation.
  7. Pipe bedding and initial cover material.
  8. Loading, hauling and disposal of surplus excavated material.
  9. Backfilling and compaction.

10. Wye's or Tee's for sewer services.
11. Complete restoration and landscaping.
12. Repair and maintenance of disturbed street surfaces.
13. Quality control testing.

#### 4.02 SEWER SERVICE

- A. Measurement shall be made horizontally along the centerline of the pipe from the centerline of the sewer main to the end of the sewer service.
- B. Property line risers, if required, shall be paid for separately under the appropriate bid item.
- C. Payment shall be made by the unit price per lineal foot and include:
  1. Pipe material, equipment, and labor.
  2. Clearing and grubbing.
  3. Stripping and stockpiling topsoil.
  4. Traffic, dust and erosion control.
  5. Loading, hauling and disposal of street surfacing and curb & gutter in trench area.
  6. Dewatering and excavation.
  7. Pipe bedding and initial cover material.
  8. Loading, hauling and disposal of surplus excavated material.
  9. Backfilling and compaction.
  10. Riser pipes.
  11. All fittings including end caps.
  12. Location markers.

#### 4.03 MANHOLES

- A. Measurement shall be made from the invert to the rim as installed.
- B. Payment shall be made by the unit price per vertical foot installed and shall include:
  1. Dewatering and excavation.
  2. All pre-cast components, steps and frame and cover.
  3. Gasketed pipe openings and joint seals.
  4. Adjusting rings and sewer joint compound.
  5. Drop manholes shall include the pre-cast drop.
  6. Chimney seals.

#### 4.04 BORING AND JACKING CASING PIPE

- A. Measurement for the casing pipe shall be made along the centerline of the casing pipe as installed.
- B. Payment shall be made by the unit price per linear foot installed and include:
  1. Labor, equipment, and material necessary to install the casing pipe.
  2. Blocking and supports necessary to anchor the sewer pipe inside the casing pipe.
  3. Placing a sand slurry, pea gravel, or fly ash slurry to completely fill the annular space between the casing and sewer pipe.
  4. The sewer pipe placed inside of the casing.

- END OF SECTION -

## SECTION 02936

### LANDSCAPING

#### PART 1 -GENERAL

##### 1.01 SUMMARY

- A. Work Included: This section includes the following:
  - 1. Preparation of subsoil.
  - 2. Placing topsoil.
  - 3. Testing and correcting soil pH, if necessary.
  - 4. Seeding, sodding, mulching and fertilizing.
  - 5. Maintenance.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern work in this section.
  - 2. Section 01300, Submittals.

##### 1.02 REFERENCES

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.
- B. Association of Official Seed Analysis (AOSA).

##### 1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01300, Submittals:
  - 1. Fertilizer certification from supplier including brand name and chemical analysis.
  - 2. Certification of conformance with AOSA attesting to seed mix, age, weed content, purity, and germination.
  - 3. Sample of mulch material upon request of Owner's representative.
  - 4. Sample of erosion mat and certification of its properties.

##### 1.04 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners. Submit sod certification for grass species and location of sod source.

##### 1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver sod on pallets or in rolls. Protect exposed roots from dehydration. Do not deliver more sod than can be laid within 24 hours.

- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

## **PART 2 - PRODUCTS**

### **2.01 TOPSOIL**

- A. Topsoil shall consist of the natural loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils adapted to the sustenance of plant life, and such topsoil shall be neither excessively acid nor excessively alkaline.
- B. 100 percent of the topsoil shall pass a one-inch sieve and at least 90 percent shall be a No. 10 sieve.

### **2.02 FERTILIZER**

- A. Type A fertilizer shall meet the following minimum requirements:
1. Nitrogen, not less than ..... 16%
  2. Phosphoric Acid, not less than ..... 6%
  3. Potash, not less than ..... 6%
  4. Sum of nitrogen, phosphoric acid and potash shall be not less than 32 percent. Total nitrogen shall be not less than the sum of the phosphoric acid and soluble potash.
- B. Type B fertilizer shall meet the following minimum requirements:
1. Nitrogen, not less than ..... 16%
  2. Phosphoric Acid, not less than ..... 6%
  3. Potash, not less than ..... 24%
  4. Sum of nitrogen, phosphoric acid and potash shall be not less than 50 percent.

### **2.03 SEED**

- A. Conform with the requirements of the governing authority for seeding and for restrictions on noxious weed seed.

- B. Seed mixture shall be composed of seeds of the purity, germination, and proportion by weight as follows:

SPECIES	PURITY minimum %	GERMINATION minimum %	MIXTURE PROPORTIONS in percent				
			NO. 10	NO. 20	NO. 30	NO. 40	NO. 60
Kentucky Bluegrass	98	85	40	6	10	35	--
Red Fescue	97	85	25	--	30	20	--
Hard Fescue	97	85	--	24	25	20	--
Tall Fescue	98	85	--	40	--	--	--
Salt Grass	98	85	--	--	10	--	--
Redtop	92	85	5	--	--	--	--
Timothy	98	90	--	--	--	--	12
Canada Wild Rye		Pure Live Seed <sup>(1)</sup>	--	--	--	--	10
Perennial Ryegrass	97	90	20	30	--	--	--
Improved Fine Perennial Ryegrass	96	85	--	--	15	25	--
Annual Ryegrass	97	90	--	--	--	--	30
Alsike Clover	97	90	--	--	--	--	4
Red Clover	98	90	--	--	--	--	4
White Clover	95	90	10	--	--	--	--
Birdsfoot Trefoil	95	80	--	--	10	--	--
Crown Vetch	95	80	--	--	10	--	--
Japanese Millet	97	85	--	--	--	--	20
Annual Oats	98	90 <sup>(1)</sup>	--	--	--	--	20

<sup>(1)</sup> Substitute winter wheat for annual oats in fall plantings started after September 1.

- C. Add 1½ bushels of oats per acre if seeded before July 15<sup>th</sup> or 1½ bushels of winter wheat if seeded after July 15<sup>th</sup> for cover crop.
- D. Birdsfoot Trefoil and Crown Vetch seed will be inoculated in accordance with manufacturer's recommendations except when hydroseeders are used. When seed is applied with hydroseeder, five times the normal rate of inoculant will be added to the hydroseeder.

## 2.04 MULCH

- A. Mulch shall consist of straw, hay, marsh hay or wood chips which are free of noxious weeds and other objectionable foreign matter.
1. If wood chips are used, the mulch area shall be treated with one (1) pound of available nitrogen per 1,000 square feet.
- B. Mulch binder shall conform to one of the following:
1. Emulsified asphalt shall meet the requirements for Type SS-1 AASHTO M140.
  2. Terra Tack 1, or equal.

## 2.05 SOD

- A. The sod shall consist of a dense, well-rooted growth of permanent and desirable grasses, indigenous to the general locality where it is to be used.
- B. Sod shall meet the following general requirements:
  - 1. Free from weeds and undesirable grasses.
  - 2. Grass length of two (2) inches.
  - 3. Cut in uniform strips 18" x 72".
  - 4. Uniform thickness of 1½-inch or more.
  - 5. Adequately watered to prevent crumbling, breaking or tearing during handling and placement.

## 2.06 TEMPORARY EROSION CONTROL BLANKET

- A. Manufacturer: North American Green, S75; American Excelsior Company, Curlex; or equal.
- B. Material Composition
  - 1. Single net: 100% photodegradable.
  - 2. Matrix: 100% agriculture straw.
  - 3. Thread: degradable.

## 2.07 PERMANENT EROSION CONTROL BLANKET

- A. Manufacturer: North American Green, P300; American Excelsior Company, Recyclex TRM; or equal.
- B. Material Composition
  - 1. Top and bottom net: 100% UV stabilized polypropylene.
  - 2. Matrix: UV stabilized polypropylene fiber.
  - 3. Thread: UV stabilized polypropylene.

## 2.08 LIMESTONE

- A. Limestone shall be ground agricultural limestone containing not less than 90% calcium carbonate and shall be ground to such a fineness that 50% shall pass a U.S. Standard Sieve No. 96 and 90% shall pass a U.S. Standard Sieve No. 100.
- B. Rates of application shall be as specified or as requested by the Engineer as a result of periodic soil testing and consultation with the district Soil Conservation Service.

## 2.09 ALUMINUM SULFATE

- A. Aluminum sulfate shall be unadulterated and delivered to the site in the manufacturer's original containers with name of the material, manufacturer's name and net weight clearly marked on each container. Aluminum sulfate shall be used only in a dry powdery state.
- B. Rates of application shall be as specified or as requested by the Engineer as a result of periodic soil testing and consultation with the district Soil Conservation Service.

## **PART 3 - EXECUTION**

### **3.01 TOPSOILING**

- A. Topsoil all areas which are required to be seeded. Place topsoil to the following depth:
1. Seeded areas: 6 inches when settled.
- B. Topsoil Placement In Rural Areas
1. Place to required depth.
  2. Remove all rocks larger than 1½ inches.
  3. Remove all debris.
  4. Mechanically break down all clods and lumps.
  5. Mechanically level and rake prior to applying seed.
- C. Topsoil Placement For Seeding Lawns
1. Mechanically level subgrade to allow uniform placement of topsoil.
  2. Remove rocks, roots, clods and other foreign material.
  3. Place topsoil to required depth.
  4. Mechanically level topsoil.
  5. Rake topsoil smooth and remove all lumps.
  6. Seed as required.

### **3.02 FERTILIZING AND LIMING**

- A. Fertilize all areas to be seeded.
- B. Apply any required fertilizer and lime uniformly onto the surface of the prepared seedbed.
- C. When hydroseeders are not used, the fertilizer and lime shall be incorporated into the top 3 inches of the soil with suitable tillage equipment.
- D. Apply fertilizer at a rate determined as a result of periodic soil testing and consultation with the district Soil Conservation Service.
- E. Use type of fertilizer best suited for area.

### **3.03 SEEDING**

- A. Selection of seed mixtures, rate of seeding and intended use of the mixtures will be as follows:

<u>Seed Mixture</u>	<u>Rate of Seeding (Lbs. per 1,000 sq. ft.)</u>	<u>Intended Use</u>
No. 10	1½	Average loam or heavy clay soils. All ditches, inslopes grass areas.
No. 20	3	Light, sandy or gravelly soils. All ditches, inslopes.
No. 30	2	In rural areas on cut and fill slopes exceeding 6 to 8 feet.



No. 40

4

In urban area or other areas where a lawn type turf is desired.

No. 60

½

Critical area stabilization.  
May be used in conjunction with mixture No. 1 and No. 2 on steep slopes.

B. Seeding period shall be as recommended by the seed supplier.

C. Seeding

1. Utilize a machine or combination of machinery which will produce the following:
  - a. Apply seed uniformly at the rate specified.
  - b. Cover seed with approximately ½ inch of topsoil.
  - c. Roll lightly.
  - d. Apply seed at right angles to surface drainage.

3.04 MULCHING

A. General

1. Place a straw or hay mulch within 72 hours after seeding.
2. Do not place during high winds.
3. Place loosely enough to allow some sunlight penetration and air circulation, but thickly enough to shade ground, conserve moisture and reduce erosion.

B. The Contractor may elect to perform mulching in accordance with one of the following methods:

1. Method "A"
  - a. Spread mulch material uniformly by blowing in place to a loose depth of ½ to 1½ inches.
  - b. Mulching shall begin at tops of slopes and proceed down.
  - c. Anchor mulch with a biodegradable netting or twine secured with pegs or staples forming a six (6) to ten (10) foot grid.
2. Method "B"
  - a. Mulch shall be treated with emulsified asphaltic material and blown in place in one operation.
  - b. Mulch shall be blown uniformly to a depth of ½ to one inch.
  - c. Mulch shall be treated with emulsified asphalt at a rate of 75 to 100 gallons per ton.
3. Method "C"
  - a. This shall be the same as Method "A" except mulch will be anchored by impressing into the soil to a depth of 1½ to 2½ inches with a tiller in a single pass.

3.05 SODDING

A. Placing Sod

1. Moisten topsoil to loosened depth of three (3) inches.
2. Place sod within 24 hours after initially cut.
3. Laying sod strips
  - a. Lay sod so abutting end joints are not continuous.

- b. Sod strips shall abut snugly against each other.
- c. Sod shall be level with adjoining turf or grade.
- d. Water and roll or lightly tamp sod immediately after placement.
- e. At the limits of the sodded area, end strips shall be staggered.
- f. At the end of all sod strips, turn sod into soil, cover with topsoil, and compact.
- 4. Laying sod on slopes and in waterways.
  - a. In waterways, place sod with longer dimension perpendicular to water flow.
  - b. On slopes, place sod with longer dimension parallel to the contours the ground.

B. Staking Sod

- 1. Stake sod in all waterways and on all slopes steeper than one (1) foot vertical to two (2) feet horizontal.
- 2. Stakes shall be wood lath minimum of twelve (12) inches long.

3.06 EROSION CONTROL BLANKET

A. Installation in Ditches (where shown on the plans).

- 1. Prepare soil including lime, fertilizer, and seed.
- 2. Place a eight (8) foot wide roll centered on ditch flowline.
- 3. Roll out blanket in the direction of the water flow and overlap ends six inches in a shingle style.
- 4. Anchor edges and ends in a 6" x 6" trench. Backfill and compact trench after stapling.
- 5. Stapling:
  - a. Install per manufacturer's instructions.

B. Installation on Slopes (where shown on the plans).

- 1. Prepare soil including lime, fertilizer, and seed.
- 2. Place blankets down or across the slope.
- 3. Seams which run down the slope shall be lapped a minimum of two (2) inches.
- 4. Seams running across the slope shall be lapped a minimum of four (4) inches shingle style.
- 5. Anchor the edges of the blanket in a 6"x 6" trench. Backfill and compact trench after stapling.
- 6. Stapling:
  - a. Install per manufacturer's instructions.

3.07 APPLICATION

A. The Contractor shall landscape all areas disturbed by construction activities on and adjacent to the construction site including:

- 1. Earthen stockpiles.
- 2. Equipment parking areas.
- 3. Areas disturbed from transporting equipment.
- 4. Areas disturbed from storing materials.

B. Apply landscaping procedures as follows:

- 1. Lawns
  - a. Topsoil
  - b. Seed

- c. Fertilize
    - d. Mulch and mulch binder
  - 2. Rural and unmowed areas
    - a. Topsoil
    - b. Seed
    - c. Fertilize
    - d. Mulch and mulch binder
  - 3. Stockpiles: Seed and mulch.
- C. Apply erosion control blankets to the following:
- 1. Ditch lines disturbed by construction as shown on the plans.
  - 2. Slopes 2:1 or greater.
- D. Sod areas as shown on plans.

### 3.08 MAINTENANCE

- A. Maintain all seeded and sodded areas until the following conditions are met:
- 1. Seeding has established a stand of grass which is uniform in density and color.
  - 2. Sodding has established a root system in to the sod bed.
  - 3. Landscaping is capable of resisting erosion.
- B. Watering of turf and repairing erosion shall be included in maintenance.
- C. Where vegetation has not been satisfactorily established. CONTRACTOR shall reseed such areas until suitable vegetation has been established.

### 3.09 MEASUREMENT AND PAYMENT

- A. Landscaping shall be incidental to other work and shall be included in the respective unit price bid item.

- END OF SECTION -

# 3

## DIVISION 3

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### CONCRETE

## SECTION 03200

### CONCRETE REINFORCEMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Work Included: Work includes furnishing, fabricating, and erecting all steel and fibers required for reinforcement of cast in place concrete as shown on the drawings.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 03300, Cast In Place Concrete.

##### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A82 Steel Wire, Plain, for Concrete Reinforcement
  - 2. ASTM A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
  - 3. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- B. American Concrete Institute (ACI):
  - 1. ACI 315 Manual of Standard Practices for Detailing Reinforced Concrete Structures.
  - 2. ACI 318 Building Code Requirements for Structural Concrete.
- C. Concrete Reinforcing Steel Institute (CRSI):
  - 1. CRSI Manual of Standard Practice

##### 1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01300, Submittals:
  - 1. Before proceeding with the fabrication of the reinforcement, submit shop drawings showing the number, size, length, bending and arrangement of the reinforcement.
  - 2. All shop drawings shall be in accordance with ACI 315.
  - 3. Quality control submittals, when requested shall consist of a certified copy of each heat analysis performed by producer and certified copies of reinforcement strength tests.

##### 1.04 PRODUCT HANDLING

- A. Delivery:
  - 1. The reinforcement shall be delivered to the site bundled, tagged and marked.
  - 2. Metal tags indicating the bar size, lengths, and other pertinent information corresponding to markings shown on placement drawings shall be used.

- B. Storage:
1. The reinforcement shall be stored at the site in a manner to prevent damage and accumulation of dirt and excessive rust.
  2. Protect reinforcing steel and welded wire fabric from surface contamination and from distortion.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Reinforcing bars shall comply with ASTM A615, Grade 60, deformed. Reinforcing bars required to be welded shall be ASTM A 706 low alloy.
- B. Steel wire shall conform with ASTM A82, plain, cold-drawn steel.
- C. Welded wire fabric shall comply with ASTM A 185, welded steel wire fabric.
- D. Reinforcement supports including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement shall be:
1. Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI manual.
  2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  3. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
  4. When the supports bear directly on the ground and it is not practical to use steel bar supports, precast concrete blocks may be used to support the bottom lift of the reinforcement. The precast blocks must be solid and of a higher strength than the concrete being placed. The blocks must provide adequate support to the reinforcement and be of proper height to provide reinforcing cover. The use of face brick, hollow concrete block, rocks, wood or other unapproved objects will not be permitted.
- E. Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs shall comply with ASTM C1116, Type III. Fibers shall be not less than ¾-inch long or greater than 1½-inch long as manufactured by Fibermesh or equal.

### **2.02 FABRICATION**

- A. General:
1. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances which comply with CRSI manual.
  2. In case of fabrication error, do not rebend or straighten reinforcement in a manner that will weaken the material.
  3. Unless otherwise noted, all end hooks dimensions shall conform with ACI standard hooks.
- B. Reinforcement with any of the following defects will not be permitted:
1. Bar lengths, depths, and bends exceeding the specified tolerances.

2. Bend or kinks not indicated on the drawings or final shop drawings.
3. Bars with reduced cross section due to excessive rusting or other causes.

C. Fabricate to dimensions shown on plans and ACI 318.

### **PART 3 - EXECUTION**

#### **3.01 PLACING REINFORCEMENT**

**A. General**

Comply with the CRSI Manual's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

1. Avoiding cutting or puncturing vapor retard/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
2. Bars partially embedded in concrete shall not be field bent except as shown on the plans or permitted by the Engineer.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers.

D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Polypropylene fiber reinforcement for slabs may be used in lieu of WWF with engineer's approval. Use fiber reinforcement at a minimum rate of 1.5 pounds fiber per batch yard of concrete or greater if required by fiber manufacturer.

- END OF SECTION -

## SECTION 03251

### EXPANSION AND CONTRACTION JOINTS

#### **PART 1 - GENERAL**

##### 1.01 SUMMARY

- A. Work Included: This section includes providing expansion and contraction in joints in cast-in-place concrete.
- B. Related sections and divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 03300, Cast-In Place Concrete.

##### 1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM D1752 Spec. for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- B. American Concrete Institute (ACI):
  - 1. ACI 302.1 Guide for Concrete Floor and Slab Construction

##### 1.03 QUALITY ASSURANCE

- A. Material Testing
  - 1. Production testing.
    - a. Contractor shall require the joint producer to perform the necessary testing of joint fillers to demonstrate conformity with applicable specifications.
    - b. All costs associated with production testing shall be considered incidental to furnishing of joint filler and as such will not be paid for separately.
  - 2. Field testing.
    - a. The Contractor shall furnish all samples and shall afford such facilities as may be required for forwarding them for testing without charge to Owner.
    - b. All laboratory costs associated with testing shall be paid for by Owner except as follows in which case they will be the responsibility of the Contractor.
      - 1) Failure of the material to meet the job specification, thus necessitating a retesting.
      - 2) Additional testing because of a change in material that may have previously been tested and accepted.
      - 3) Testing to be performed by an independent testing agency approved by Owner.

##### 1.04 SUBMITTALS

- A. Submit the following in accordance with Section 01300, Submittals:
  - 1. Provide two (2) copies of producer's certification that supplied materials meet requirements of applicable specifications.
  - 2. Materials.



- a. Submit samples of each type of joint filler to be used, when requested by Owner's Representative.

## **PART 2 - PRODUCTS**

### 2.01 MATERIALS

- A. Joint Fillers
  1. ASTM D1752, Type I and II as shown on the plans.
- B. Expansion joints shall have ½-inch thick cork expansion joint filler meeting ASTM D1752 – Type 1 or 111 produced by W. R. Meadows, or equal.
- C. Expansion joints in exterior concrete walks, slabs on grade, and other structures shall be ½-inch thick asphalt expansion joint filler meeting ASTM D994 produced by W. R. Meadows, or equal.

## **PART 3 - EXECUTION**

### 3.01 EXPANSION JOINTS

- A. Location and geometry of expansion joints shall be as shown on plans, or according to the following criteria.
  1. At right angle or tee intersections.
  2. At walkway and stoop intersections.
  3. Where walkways adjoin vertical surfaces.
  4. Where walkways adjoin existing pavements.
  5. Maximum spacing 100 feet unless otherwise noted on plans.
  6. At 300 feet intervals and points of radius on curb and gutter.
- B. Extend filler full width and depth of concrete, with top slightly below finished surface of concrete.

### 3.02 CONTRACTION JOINTS

- A. Location
  1. Locate contraction joints where shown on plans, or according to the following criteria for non-structural slabs:
    - a. Floors.
      - 1) Column spacing 25 feet or less - maximum 25 feet spacing each way.
      - 2) Column spacing more than 25 feet - maximum 15 feet spacing each way.
      - 3) Joints shall be laid out from column to column with diamond shape at columns in center of floor or triangle at column at end of floor.
    - b. Slabs on grade.
      - 1) Slab width 20 feet or less - use slab width as maximum allowable spacing.
      - 2) Slab width more than 20 feet - maximum 20 feet spacing each way.
    - c. Locate no contraction joint less than 5 feet from any other joint.
    - d. Locate joints to match like joints in previously constructed adjacent slabs.
      - 1) If joints are formed in section, there shall be no offsets or concrete struts between adjacent joints.

- 2) Take into consideration location of equipment bases and similar separately placed sections.
- 3) Unless shown otherwise on plans, joints shall not deviate more than five degrees from a right angle measured at intersecting joints and at slab edges.
- 4) No joint shall deviate more than ½ inch from a straight line.

2. Locate contraction joints every 10 lineal feet of curb and gutter.

B. Dimensions of Contraction Joints.

1. Depth.
  - a. Minimum 1 inch or 1/5 of slab depth, whichever is greater.
2. Width.
  - a. Minimum 1/8 inch for sawed joints, ¼ inch for other types.
  - b. Maximum ¼ inch for sawed joints, 3/8 inch for other types.

C. Criteria for Joint Selection.

1. Sealed joint.
  - a. Methods.
    - 1) Tooled joint.
    - 2) Strip-formed joint.
  - b. Use sealed joints only where shown on plans.
2. Open joint.
  - a. Methods.
    - 1) Tooled joint.
    - 2) Sawed joint, only where shown on plans.

D. Formation of Tooled Joints

1. Insert a metal parting strip into concrete after it has been struck off and consolidated, and while concrete is still plastic.
2. Remove strip when concrete is able to retain its shape.

E. Formation of Sawed Joints

1. Conform to ACI 302.1.
2. Saw joints as soon as practicable after concrete has set sufficiently to preclude raveling during sawing and before any shrinkage cracking takes place in concrete.

F. Formation of Strip-Formed Joints

1. Use plastic joint former with removable top portion.
2. Remove upper portion of strip, after concrete has sufficiently hardened, in such a manner as to prevent damage to surface of slab.

- END OF SECTION -

## SECTION 03303

### CAST IN PLACE CONCRETE – STREET WORK PAVEMENT, CURB AND GUTTER, SIDEWALK, AND DRIVEWAY

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Work Included: This section provides cast-in place concrete for street work.
- B. Related Sections and Divisions:
  - 1. Applicable provisions of the General Conditions shall govern the work in this section.
  - 2. Section 01300, Submittals.
  - 3. Section 02201, Earthwork Roadway Construction.
  - 4. Section 02235, Crushed Aggregate Basecourse.
  - 5. Section 03200, Concrete Reinforcement.
  - 6. Section 03251, Expansion and Contraction Joints.
  - 7. Section 03304, Colored and Stamped Concrete.

##### 1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM).
  - 1. ASTM A185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
  - 2. ASTM C31 Making and Curing Concrete Test Specimens in the Field.
  - 3. ASTM C33 Specification for Concrete Aggregates.
  - 4. ASTM C39 Test for Compressive Strength of Cylindrical Concrete Specimens.
  - 5. ASTM C94 Specification for Ready-Mixed Concrete.
  - 6. ASTM C143 Test for Slump of Portland Cement Concrete.
  - 7. ASTM C150 Specification for Portland Cement.
  - 8. ASTM C172 Sampling Fresh Concrete.
  - 9. ASTM C231 Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - 10. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 11. ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Lb (44.5-N) Rammer and 18-in. (457 mm) Drop.
  - 12. ASTM D1751 Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type).
  - 13. ASTM E329 Standard Recommended Practice for Inspection Testing Agencies for Concrete, Steel, and Bituminous Materials Used in Construction.
- B. American Concrete Institute (ACI).
  - 1. ACI 304 Institute ACI Measuring, Mixing, Transporting, and Placing
  - 2. ACI 305 Concrete, Recommended Practice for Hot Weather.
  - 3. ACI 306 Concreting, Recommended Practice for Cold Weather.
  - 4. ACI 347 Concreting, Recommended Practice for Concrete Formwork.

- C. State of Wisconsin Department of Transportation, Division of Highways; Standard Specifications for Highway and Structure Construction, latest edition.

### 1.03 SUBMITTALS

- A. Submit shop drawings and test reports in accordance with Section 01300, Submittals
- B. Submit the following information:
1. Concrete Mix Design.
  2. Gradation of fine and coarse aggregate – ASTM C33
  3. Test of deleterious substances in fine and coarse aggregate – ASTM C33
  4. Specific gravity and dry rodded density of each aggregate.
  5. 7-day and 28-day compressive strengths for each concrete mix proposed.
  6. Certified mill test results for cement identifying brand, type, and chemistry of cement.
  7. Brand, type, principal ingredients, and amount of each admixture.
  8. Field quality control results.

### 1.04 QUALITY ASSURANCE

- A. Contractor shall contract with an established independent testing agency to provide testing services as follows:
1. Material Acceptance Testing:
    - a. Design mix.
  2. Installation Testing:
    - a. Slump.
    - b. Air-entrainment.
    - c. Compressive strength test.
  3. Additional Testing:
    - a. Perform under following circumstances:
      - 1) Material failure.
      - 2) Change in ready-mix source.
      - 3) Design mix changes requested by Contractor.
- B. The following shall be in accordance with the stated references:
1. Inspection and Testing: ASTM E329.
  2. Sampling: ASTM C172.
  3. Slump: ASTM C143.
  4. Air-Entrainment: ASTM C231.
  5. Compressive Strength Test: ASTM C31 and C39.
- C. Perform slump, air entrainment, and compressive strength tests required by this section with the following frequency:
1. Two tests daily or one per 100 cubic yards placed, whichever number is greater.
- D. Compressive strength test shall consist of four standard test cylinders made from a single batch of concrete:
1. Test one cylinder at 7 days.
  2. Test two cylinders at 28 days.
  3. Remaining cylinder shall be tested in the event prior tests fail.

4. Compressive strength tests shall be considered satisfactory when 28-day tests meet the following:
    - a. Test results equal or exceed specified compressive strength.
    - b. No individual test falls more than 500 psi below specified compressive strength.
  5. Failure of compressive strength tests shall result in following additional testing:
    - a. Provide two core samples of each portion of work affected and perform compressive strength tests.
    - b. Replace work if core samples do not equal or exceed specified compressive strength.
  6. When the testing results show that the work is of an acceptable nature, the acceptance of the work shall not relieve the Contractor from making corrections to the tested work during the warranty period.
- E. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- F. Nondestructive Testing  
Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- G. Additional Tests  
The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.
- H. The cost of testing services shall be included in the lump sum base bid price.
  1. Submit two (2) copies of the composition and strength testing results for design mix.

## **PART 2 - PRODUCTS**

### **2.01 CEMENT**

- A. Portland cement shall be Type I, Type II, or Type III Portland Cement conforming to the requirements of ASTM Designation C150 or Type IA, Type IIA, or Type IIIA Air-Entraining Portland Cement conforming to the requirements of ASTM Designation C175.

### **2.02 AGGREGATE**

- A. Aggregate shall conform to ASTM C33.
- B. Aggregate shall consist of clean, hard, durable sand and crushed rock, crushed gravel, or gravel. Coarse aggregate shall meet the grading requirements for size No. 57, 67 or 467 (Wis/DOT Standard Size No. 1 or mixture of Size No. 1 and 2). Ratio of coarse aggregate to fine aggregate shall not be less than 1: 1 nor more than 2: 1.

## 2.03 AIR-ENTRAINING ADMIXTURE

- A. Air-Entraining Admixture shall conform to ASTM C260.

## 2.04 WATER-REDUCING, SET-CONTROLLING ADMIXTURES

- A. Water-Reducing, Set-Controlling Admixtures shall conform to ASTM C494, Type A for water-reducing, Type D for water-reducing and retarding, and Type E for water-reducing and accelerating.

## 2.05 CURING COMPOUND

- A. Curing Compound shall be ASTM C309, Type 2; resin, white pigmented.

## 2.06 REINFORCEMENT BARS

- A. All reinforced concrete to meet or exceed the minimum requirements of ACI 318.
- B. Reinforcement shall conform to Section 03200 Concrete Reinforcement.
- C. Reinforcement shall be ASTM A615, Grade 60.
- D. Fabric shall be 6 inches by 6 inches – W2.0 x 2.0 WWF
- E. Polypropylene fibers shall comply with ASTM C1116, Type III.

## 2.07 EXPANSION JOINT

- A. Expansion joints shall conform to Section 03251, Expansion and Contraction Joints.
- B. Thickness shall be 1/2-inch.

## 2.08 MIX DESIGN

- A. Concrete mixes shall be designed on the basis of compressive strength by methods specified in ACI 211.1, ACI 318, and ASTM C94 containing no less than the specified minimum cement content. Concrete mix designs complete with sample test results shall be submitted to the Engineer for approval prior to placing any concrete.

## 2.09 CONCRETE CLASSES

A. <u>Classes</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Minimum compressive strength (psi)	28-day 4,000	28-day 2,000	28-day 3,000	3-day 2,000
Minimum cement (bags/c.y.)	6	4.5	5.5	7
Air content, (%) by volume	6 ±1.5	2-4	2-4	6 ±1.5
Maximum slump (inches)	3	4	4	3
Use	Pavements, curbs, walks, structures, end walls	Pavement base, cradles & inlet walls	Manhole bases,	High early strength special const.

Note: Slip formed concrete shall contain 7.0% air entrainment ±1.5%.

B. Contractor may submit for approval alternate mix designs for non-water retaining concrete. Compressive strength of mix shall be verified. Contractor shall be responsible for removing and replacing all concrete not meeting required compressive strength.

C. Maximum aggregate size  $\frac{3}{4}$ -inch.

#### 2.10 ADMIXTURES

A. Admixtures may be added to achieve a desired result provided such admixture does not adversely affect strength and durability of the concrete.

B. Calcium chloride will not be permitted.

#### 2.11 DETECTABLE WARNING FIELDS

A. Detectable Warning Fields shall be provided by Meta Dome, LLC; Neenah Foundry; Advantage Tactile Systems; or equal.

B. Warning field size shall be as noted on plans.

C. Warning field shall be stainless steel or cast iron and provide a dark on light or light on dark color contrast. Coating shall be skid-resistant.

### **PART 3 - EXECUTION**

#### 3.01 BATCHING

A. During hot weather, the temperature of the concrete shall be less than 90°F. Work shall be in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting."

B. During cold weather, no frozen materials or materials containing ice shall be used. Temperatures of materials, including mixing water, shall not exceed 140°. When placed in forms the concrete shall have a temperature between 50°F and 90°F. Work shall be in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting."

#### 3.02 MIXING AND DELIVERY

A. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C94 and ACI 304. The production facilities shall comply with the requirements of the National Ready Mixed Concrete Association Certification Plan as regards materials storage and handling, batching equipment, central mixer, truck mixers, agitators, non-agitating units, ticketing system, etc.

B. Concrete shall be delivered to the site of the work and the mixed concrete discharged completely within 1-1/2 hours after water has been added to cement. In hot weather, or under conditions contributing to quick stiffening of concrete, this time may be reduced by the Engineer.

C. No water shall be added on the job unless authorized by the Engineer; the amount of water, if added, shall be recorded on all copies of the delivery ticket hereinafter required. If water is

permitted to be added to mixed concrete upon arrival at the job, an additional mixing of 30 revolutions of the drum shall be required.

- D. Concrete delivered shall arrive at the site having a temperature not less than 50°F nor greater than 90°F unless otherwise permitted by the Engineer.

### 3.03 DELIVERY TICKETS

- A. With each load of concrete delivered to the job there shall be furnished by the ready-mixed concrete producer duplicate delivery tickets, one for the Contractor, and one for the Engineer/Architect. Delivery tickets shall provide the following information:

1. Date and serial number of ticket;
2. Name of ready-mixed concrete plant;
3. Job location;
4. Contractor;
5. Type and brand name of cement;
6. Mix number or specified cement content in bags per cubic yard of concrete;
7. Truck number;
8. Time dispatched stamped by a time clock;
9. Amount of concrete in load in cubic yards;
10. Admixtures in concrete, if any;
11. Maximum size of aggregate;
12. Water added at job, if any;
13. Slump of concrete ordered

### 3.04 PREPARATION OF THE SUBGRADE

- A. Excavate subgrade to line and grade shown on plans and details.
- B. Thoroughly compact the subgrade and finish to a trim surface. All soft or unsuitable material shall be removed and replaced with specified materials.
- C. Provide crushed aggregate base course to thickness as shown on the plans and details.
- D. Compact to minimum 95 percent Modified Proctor density, ASTM D1557.
- E. Surplus material may be used in fill areas.
- F. Excess material shall be disposed at a site provided by Contractor.

### 3.05 FORMING

- A. Conform to ACI 347.
- B. Forms shall result in a final structure that conforms to shapes, lines, and dimensions of slabs as required by plans and specifications.
- C. Forms shall be properly braced to maintain position and shape.
- D. Clean and coat forms with clear, non-staining mineral or paraffin base form oil.



- E. Reinforcement, forms, and ground with which concrete will be in contact shall be free from frost and debris.
- F. Soak subgrade before placement of concrete slabs on grade.
- G. Remove laitance and other unsound material before additional concrete is placed against hardened concrete.
- H. Have equipment on hand to protect newly placed concrete from rain, freezing, and hot weather until it has hardened sufficiently to resist damage.
- I. Unless noted otherwise, furnish the following minimum thicknesses:
  - 1. Sidewalks: 4-inch
  - 2. Driveways and sidewalks through driveways: 6-inch

### 3.06 SLIP FORMING

- A. Coordinate mixing, delivering, and placing of the concrete to provide a uniform progress with the stopping and starting of the machine held to a minimum.
- B. Slip form machine shall be capable of placing the specified concrete section with an adequate amount of vibration to preclude the possibility of honeycomb formation.

### 3.07 PLACING

- A. Contractor shall notify Engineer of concrete placing schedule one day in advance of pour to allow for inspection of reinforcing and forms.
- B. Once placing operation commences, it shall be carried out as a continuous operation until a section is completed.
- C. Placing should be carried on in such manner that the concrete in the form is still plastic and can be integrated with fresh concrete.
- D. Concrete shall not be placed in water. Water level shall be removed or lowered in a manner approved by Engineer.
- E. Concrete shall be placed before initial set has occurred. Excess water will not be permitted. Powdering a mixture with cement to absorb excess water will not be permitted.
- F. Dump trucks may be used for transporting mixed concrete to the desired location. If segregation of the concrete becomes evident, the use of dump trucks will not be permitted.
- G. Where chutes are used to transport concrete, they shall be of metal or wood with metal lining. They should have a slope not exceeding one vertical to two horizontal and not less than one vertical to three horizontal so that the concrete will travel fast enough to keep the chute clean but slow enough to avoid segregation of materials. The end of each chute shall be provided with a baffle to help prevent segregation, or the concrete should be discharged through a tremie or elephant trunk directly into the form.

- H. Concrete shall not fall freely more than 4 feet. Elephant trunks and/or tremies shall be used to prevent free fall of the concrete.
- I. Concrete shall be deposited in approximately horizontal layers not to exceed 18 inches in height to avoid segregation due to re-handling and flowing.
- J. Pumping equipment shall be of suitable type, without Y-sections, and with adequate pumping capacity. Loss of slump in pumping shall not exceed 1-1/2 inches.
- K. The concrete shall be thoroughly compacted by means of an approved vibrator, with the period of vibration being not less than 2 seconds nor more than 5 seconds at any one point.

### 3.08 PLACEMENT OF DETECTABLE WARNING FIELDS

- A. Physical characteristics of the concrete shall be consistent with the contract specifications.
  - 1. Concrete shall be poured and finished, to required dimensions and slope prior to placement.
  - 2. Cast-in-place tiles shall be tamped or vibrated into fresh concrete to ensure field of tile is flush to the adjacent concrete surface and all voids under tile are filled. Maximum tolerance for elevation differences between tile and adjacent surface is 1/16".
    - a. Concrete shall be troweled around the tile perimeter to the field level of the tile.
    - b. Following placement and approved placement slope and location, before the concrete sets two suitable weights of 25 lbs each shall be placed on each tile to ensure solid contact to concrete.
    - c. Following curing of concrete, protective plastic wrap shall be removed from the tile face.

### 3.09 PLACEMENT OF HANDICAP RAMPS

- A. Place handicap ramps where shown on plans or as directed by Owner's Representative.

### 3.10 FINISHING

- A. Finish concrete true to required level and grade to a tolerance of:
  - 1. True plane within 1/4-inch in 10 feet.
- B. Float as follows:
  - 1. Tamp concrete for force aggregate away from surface.
  - 2. Screed with straight edges and bring to required line.
  - 3. Float surface to a true and uniform plane with no coarse aggregate visible.
  - 4. Do not dust surface with dry materials to remove excess water.
- C. Broom at right angles to traffic.
- D. Face surfaces of the curb and gutter shall be troweled and finished smooth.
- E. Round exposed edges with an edger having 1/4-inch radius.

- F. Point honeycombed areas with mortar composed of three parts sand and one part Portland cement immediately after the curb and gutter has been placed.

### 3.11 ENVIRONMENTAL REQUIREMENTS

- A. Follow ACI 305 whenever mean surrounding air temperature equals or exceeds 80°F (27°C).
- B. Do not place concrete whenever air temperature equals or exceeds 90°F (32°C).
- C. Follow ACI 306 whenever mean surrounding air temperature is below 40°F (4.5°C).
- D. Do not place concrete during rain, sleet, or snow unless protection is provided.

### 3.12 EXISTING CONCRETE FLATWORK

- A. When abutting to existing flatwork, provide the following:
  - 1. Saw cut existing concrete at construction limits.
  - 2. Install expansion joints between existing and new construction.

### 3.13 CONTRACTION JOINTS

- A. Sawcut curb and gutter at 10-foot intervals to a minimum depth of 2 inches.
- B. For sidewalks, use sidewalk width as maximum spacing or 5 feet, whichever is greater. Do not use less than 3 feet or greater than 12 feet of spacing.
- C. Sawcut pavement as shown on the pavement joint details.
- D. Saw joints as soon as practical after concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracks occur.

### 3.14 EXPANSION JOINTS

- A. Place as follows:
  - 1. 300 foot maximum spacing on tangent sections curb and gutter and sidewalk.
  - 2. Where radial curb and gutter meet tangent sections.
  - 3. Adjacent to existing joints in abutting concrete paving.
  - 4. Place at right angles to the flowline and surface of the gutters.
  - 5. Expansion joint material shall be one piece and extend the full depth and width of the curb and gutter or concrete section.
  - 6. Place expansion joint in pavement sections as shown on the plans and details.

### 3.15 REINFORCEMENT BARS

<b>PROJECT MANAGER—CHOOSE ONE OF THE FOLLOWING LETTER A'S</b>
---

- A. Provide (2) #4 bars when continuously reinforced curb and gutter is specified.
  - 1. Place bars continuous from catch basin to catch basin, and terminate bars on top of casting flange.
  - 2. Splices shall lap a minimum of twelve inches and shall be wire tied.

3. Support bars such that they are held firmly in place and are 3 inches above bottom of curb and gutter.

**OR**

- A. Provide (2) #4 x 20-foot long rebar at each utility trench crossing.
  1. Center reinforcement on centerline of trench.
  2. Accurately position, support, and secure reinforcement against displacement. Reinforcement shall be supported 3 inches clear to basecourse by metal chairs, bolsters, or concrete brick.
- B. Place reinforcement and dowel bars for pavement sections as shown on the plan details.

### 3.16 RESTORATION

- A. Backfilling
  1. Backfill low areas with soil that meets Engineer's prior approval.
    - a. Between concrete structure and property line.
    - b. Shape to line and grade to permit landscaping.
- B. Landscape areas disturbed by construction in accordance with section: "Landscaping."
- C. Contractor shall be responsible for all trees and shrubs damaged during construction and will be obligated to make restitution for said damage.
- D. If Contractor fails to complete restoration or provide maintenance prescribed, the Owner reserves the right to complete this work and deduct it from moneys due.

### 3.17 CURING AND PROTECTION

- A. Use a white pigmented curing compound conforming to ASTM C309, Type 2.
- B. Hot Weather Conditions: Conform to ACI 305.
- C. Cold Weather Conditions: Conform to ACI 306.
- D. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shock, and vibration.

## **PART 4 MEASUREMENT AND PAYMENT**

### 4.01 GENERAL

- A. Cast-in-place concrete - street work shall be paid for at the bid price in accordance with one of the following methods, unless indicated otherwise in the Bid Form.
  1. Cast-in-Place Concrete - Street Work. Unit Price. When so provided, payment for cast-in-place concrete-street work shall be made at the contract unit price bid as specified for concrete pavement, curb and gutter, concrete sidewalk, steps and driveways.
    - a. Payment for cast-in-place concrete - street work shall include all base preparation and grading as specified for concrete pavement, curb and gutter, concrete sidewalk, steps and driveways.

- b. Payment for cast-in-place concrete - street work shall include minimum compacted thickness of base course and sub base course material as specified for pavement, concrete curb and gutter, concrete sidewalk, steps and driveways.

B. Measurement

- 1. Measurement shall be made along the edge of concrete for pavement, sidewalks, and driveways. Square feet will be calculated based on actual length and width. Irregular shaped areas will be calculated based on average length and width.
- 2. Lineal measurement shall be made in the flow line for curb and gutter.

C. Payment

- 1. Payment shall be made at the unit price per square feet or per lineal as indicated in the bid schedule.
- 2. Unit price shall include:
  - a. Removal of existing.
  - b. Foundation preparation.
  - c. Forming.
  - d. Placing and finishing concrete.
  - e. Labor, equipment and material.

D. Detectable warning field shall be paid for at the contract unit price.

E. Adjusting utility appurtenances in or adjacent to concrete pavement, curb and gutters, sidewalks, steps, driveways and retaining walls will be considered inclusive to payment for work associated with concrete pavement, curb and gutter, sidewalks, steps, and driveway construction and no additional compensation will be allowed unless indicated in the Bid Form.

- END OF SECTION -

# 17

## DIVISION 17

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### DETAIL & DRAWINGS

PROPERTY LINE  
OR  
EASEMENT LINE  
1'-0" MIN.

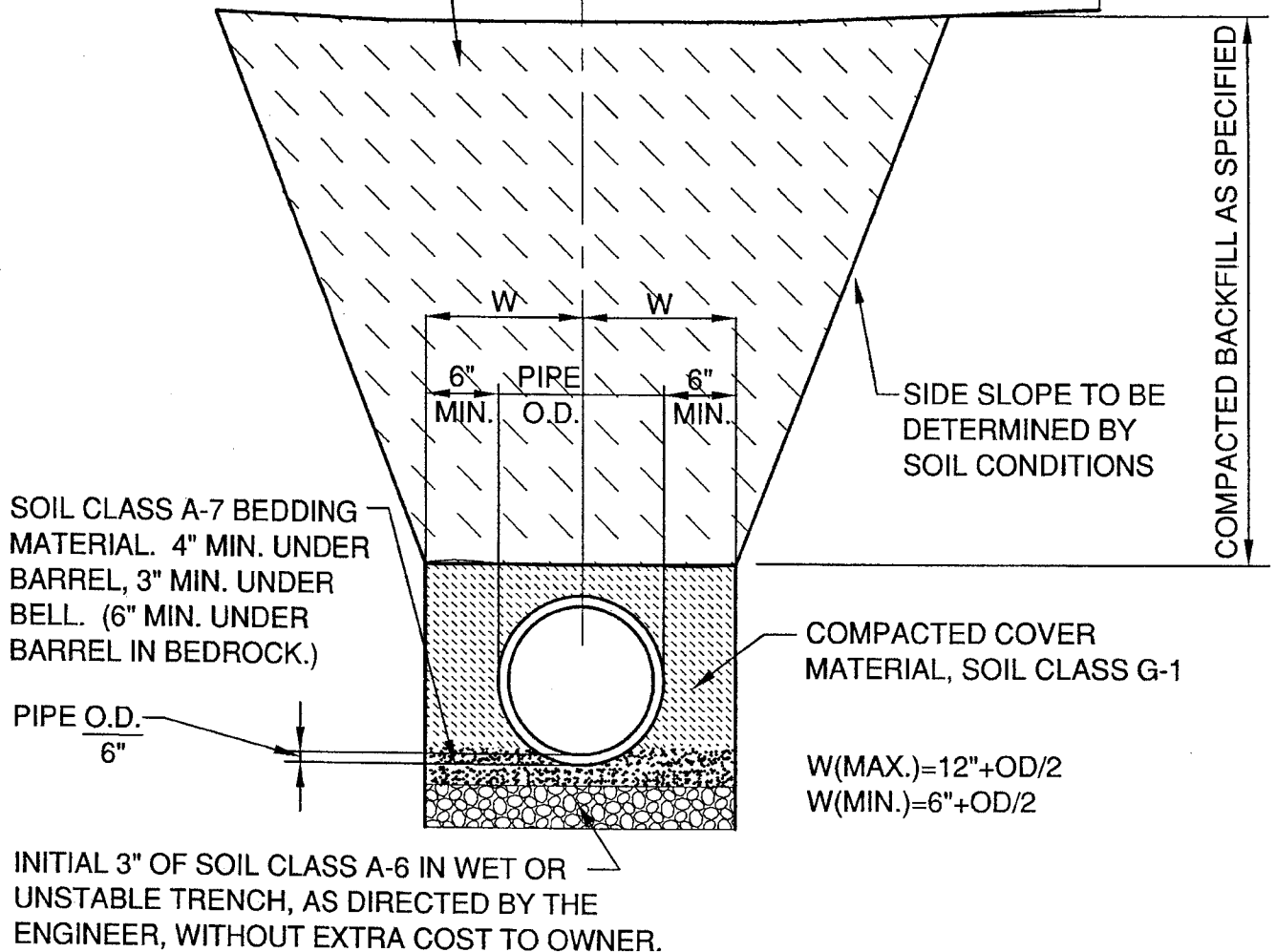


NOTE:  
SURFACE RESTORATION  
REQUIREMENTS PER  
SPECIFICATIONS

SOIL CLASS G-1 OR  
C-3 IF REQUIRED PER  
SPECIFICATIONS

PROPERTY LINE  
OR  
EASEMENT LINE

1'-0" MIN.



## CONCRETE PIPE BEDDING & TRENCH SECTION



SOIL CLASS G-1 OR  
C-3 IF REQUIRED PER  
SPECIFICATIONS

12" MIN.

WATER SERVICE ON  
SHELF EXCAVATED AT  
SIDE OF TRENCH

COMPACT BEDDING  
& COVER MATERIAL,  
SOIL CLASS A-8

6" MIN.

1/10 TRENCH  
HEIGHT OR  
12" MIN.

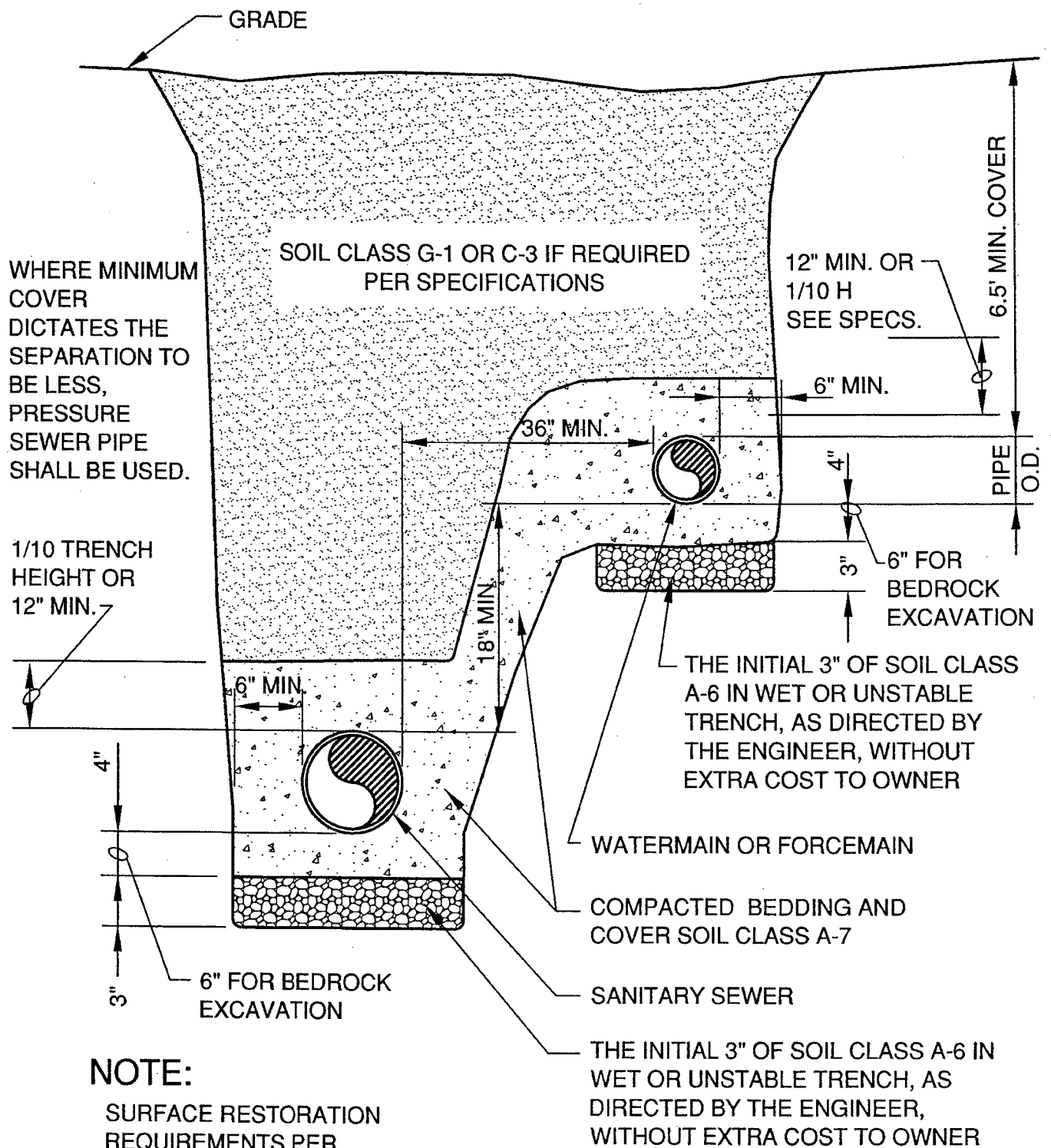
4" MIN.

COMPACT BEDDING  
AND COVER, SOIL  
CLASS A-7

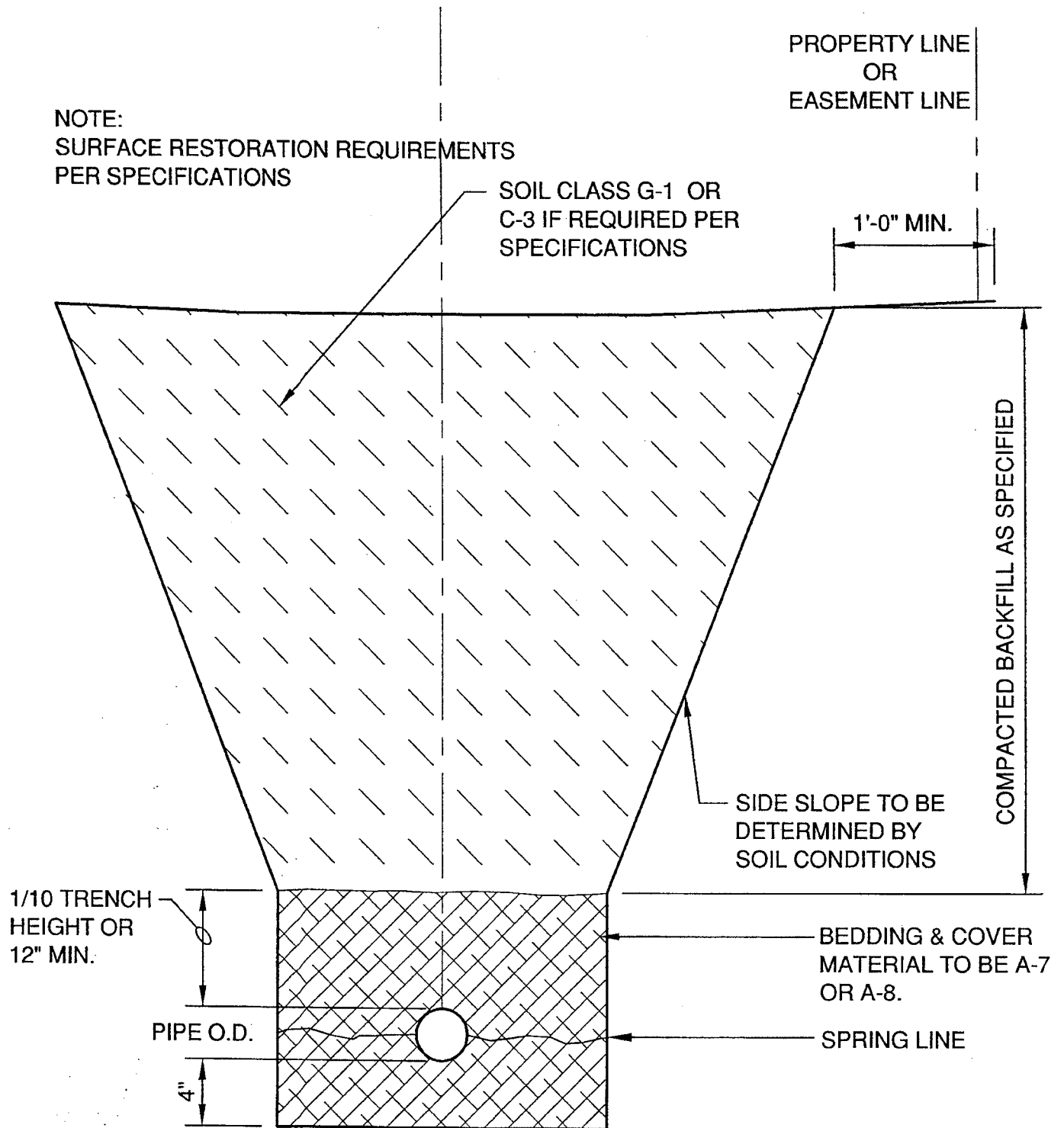
SEWER LATERAL

INITIAL 3" OF SOIL CLASS A-6 IN WET  
OR UNSTABLE TRENCH, AS  
DIRECTED BY THE ENGINEER,  
WITHOUT EXTRA COST TO OWNER.

## SEWER & WATER LATERALS IN COMMON TRENCH



## SEWERMAIN & WATERMAIN IN COMMON TRENCH



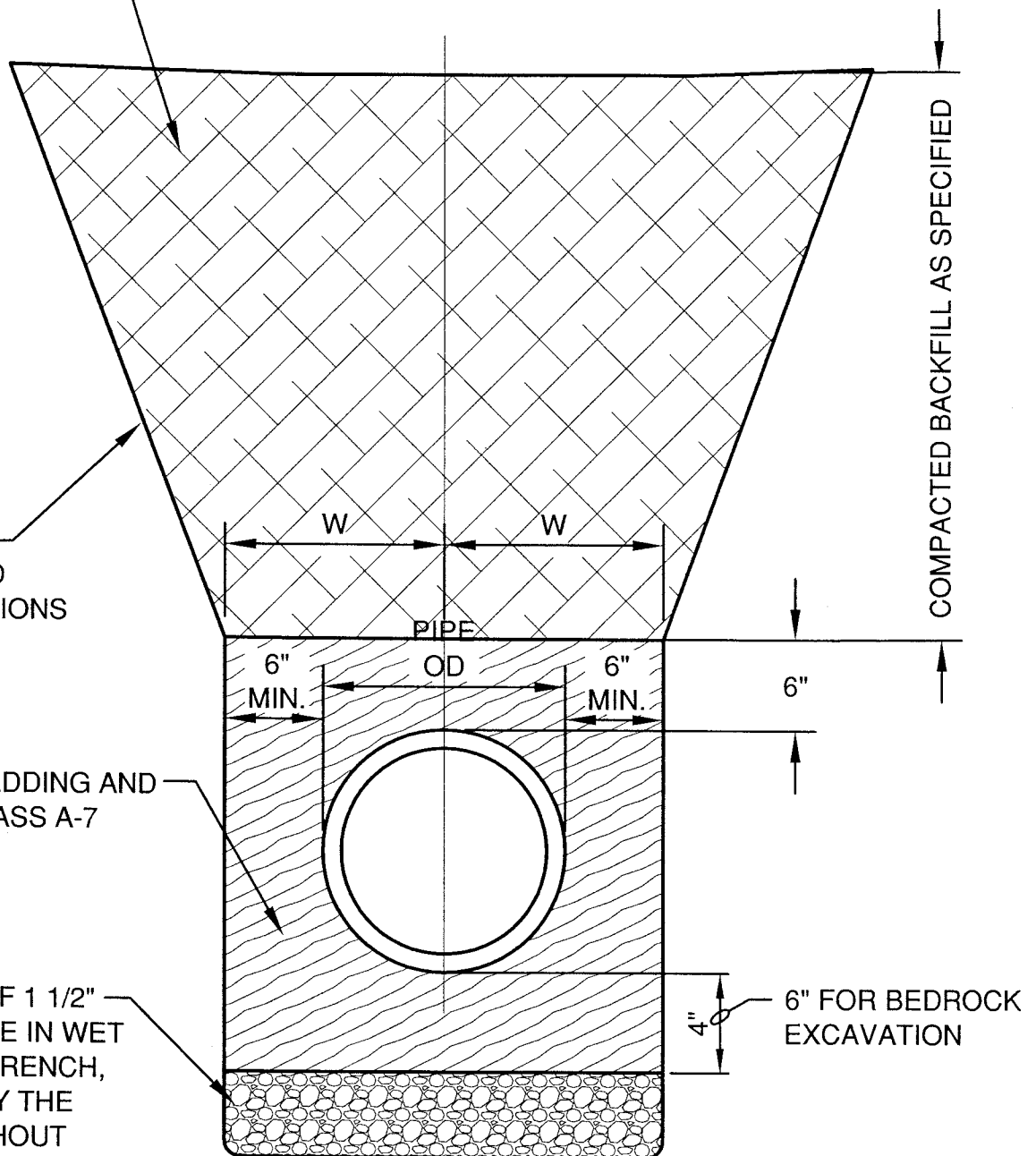
**SMALL DIAMETER PIPING (UNDER 4" DIA.)  
PVC, COPPER, STEEL, AND POLYETHYLENE**

SOIL CLASS G-1 OR  
C-3 IF REQUIRED PER  
SPECIFICATIONS

SIDE SLOPE TO  
BE DETERMINED  
BY SOIL CONDITIONS

COMPACTED BEDDING AND  
COVER SOIL CLASS A-7

THE INITIAL 3" OF 1 1/2"  
CRUSHED STONE IN WET  
OR UNSTABLE TRENCH,  
AS DIRECTED BY THE  
ENGINEER, WITHOUT  
EXTRA COST TO OWNER.



$$W(\text{MAX.}) = 12" + OD/2$$

$$W(\text{MIN.}) = 6" + OD/2$$

## DUCTILE IRON BEDDING & TRENCH SECTION

TWO CONTINUOUS STRIPS OF 3/8" X 1/2" JOINT SEAL OR EQUAL BETWEEN ADJUSTING RINGS. COAT OUTSIDE OF ADJUSTING RINGS ONLY WITH SEWER JOINT COMPOUND AND WRAP WITH MIN. 6 MIL POLYETHYLENE.

PVC COATED CAST IRON M.H. STEPS - 16" O.C.

MANHOLE CASTING & LID AS SPECIFIED.

CONCRETE ADJUSTING RINGS AS REQUIRED. 4" MIN. AND 12" MAX. UNLESS OTHERWISE NOTED.

ECCENTRIC REDUCING CONE (VERTICAL WALL OF ECCENTRIC CONE SHALL BE ON DOWNSTREAM SIDE OF MANHOLE. THIS DETAIL SHOWN ROTATED 90° FOR CLARITY.)

CONTINUOUS 1-1/4" X 1-1/4" JOINT SEAL OR EQUAL AT EACH JOINT.

TONGUE & GROOVE JOINT WHERE REQUIRED.

FLEXIBLE PIPE TO MANHOLE CONNECTOR FOR SANITARY SEWER PIPE.

8" PRECAST CONCRETE BASE

PRECAST CONCRETE MANHOLE SECTIONS

3'-0"

2'-0" DIA.  
MIN.

4'-0" DIA.

5'-8" MIN.

## SANITARY AND STORM STANDARD MANHOLE 8"-18" (INCLUSIVE)

TWO CONTINUOUS STRIPS OF  
3/8" x 1/2" JOINT SEAL OR EQUAL  
BETWEEN ADJUSTING RINGS  
COAT OUTSIDE OF ADJUSTING  
RINGS ONLY WITH SEWER JOINT  
COMPOUND AND WRAP WITH  
MIN. 6 MIL POLYETHYLENE

PVC COATED CAST IRON  
M.H. STEPS - 16" O.C.

MANHOLE CASTING &  
LID AS SPECIFIED

CONCRETE ADJUSTING RINGS AS  
REQUIRED. (4" MIN. AND 12" MAX.  
UNLESS OTHERWISE NOTED)

ECCENTRIC REDUCING CONE  
(VERTICAL WALL OF ECCENTRIC  
CONE SHALL BE ON  
DOWNSTREAM SIDE OF  
MANHOLE. THIS DETAIL SHOWN  
ROTATED 90° FOR CLARITY)

CONTINUOUS 1-1/4" x  
1-1/4" JOINT SEAL OR  
EQUAL AT EACH JOINT.

TONGUE & GROOVE JOINT  
WHERE REQUIRED

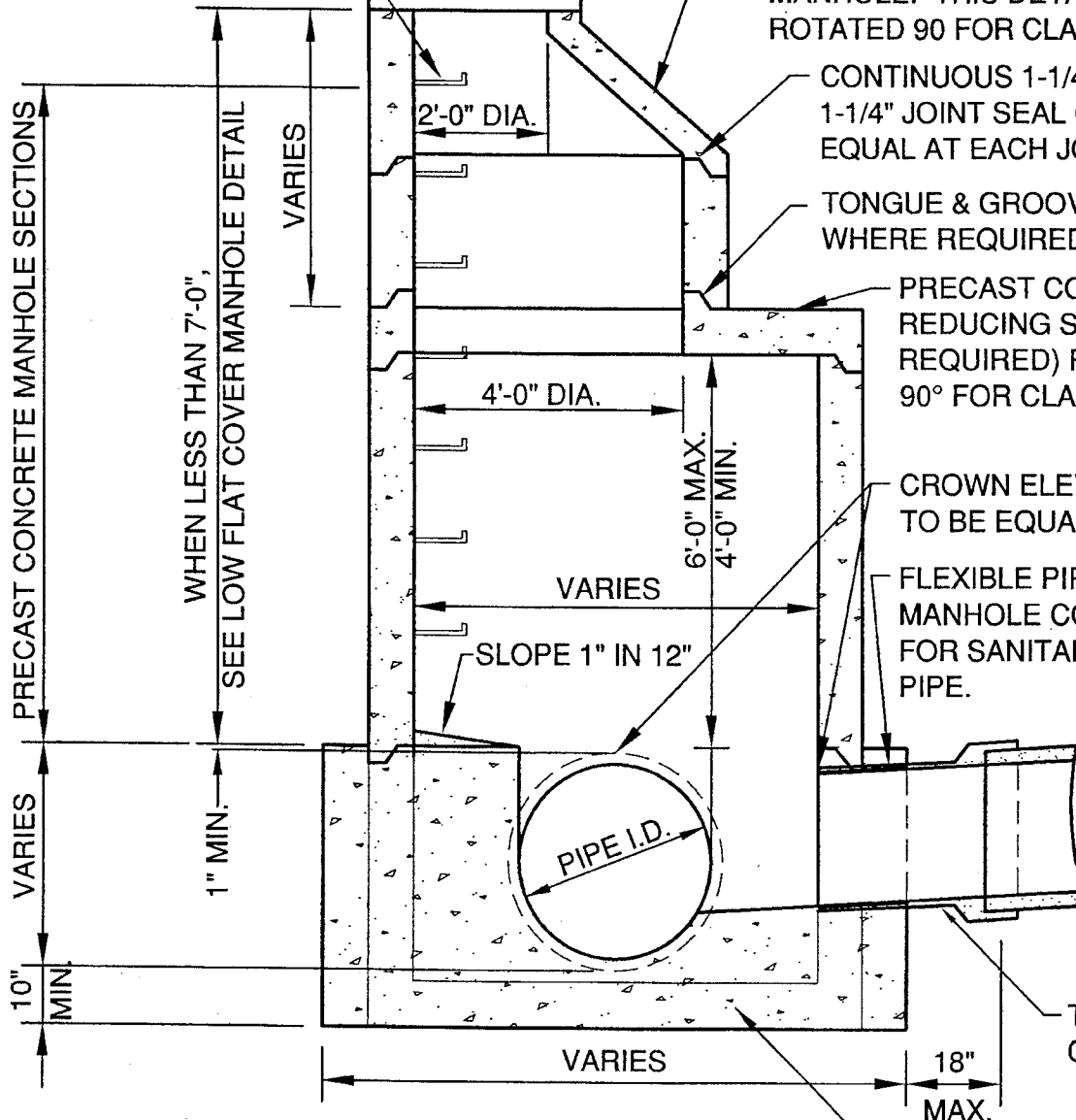
PRECAST CONCRETE  
REDUCING SLAB (AS  
REQUIRED) ROTATED  
90° FOR CLARITY

CROWN ELEVATION  
TO BE EQUAL

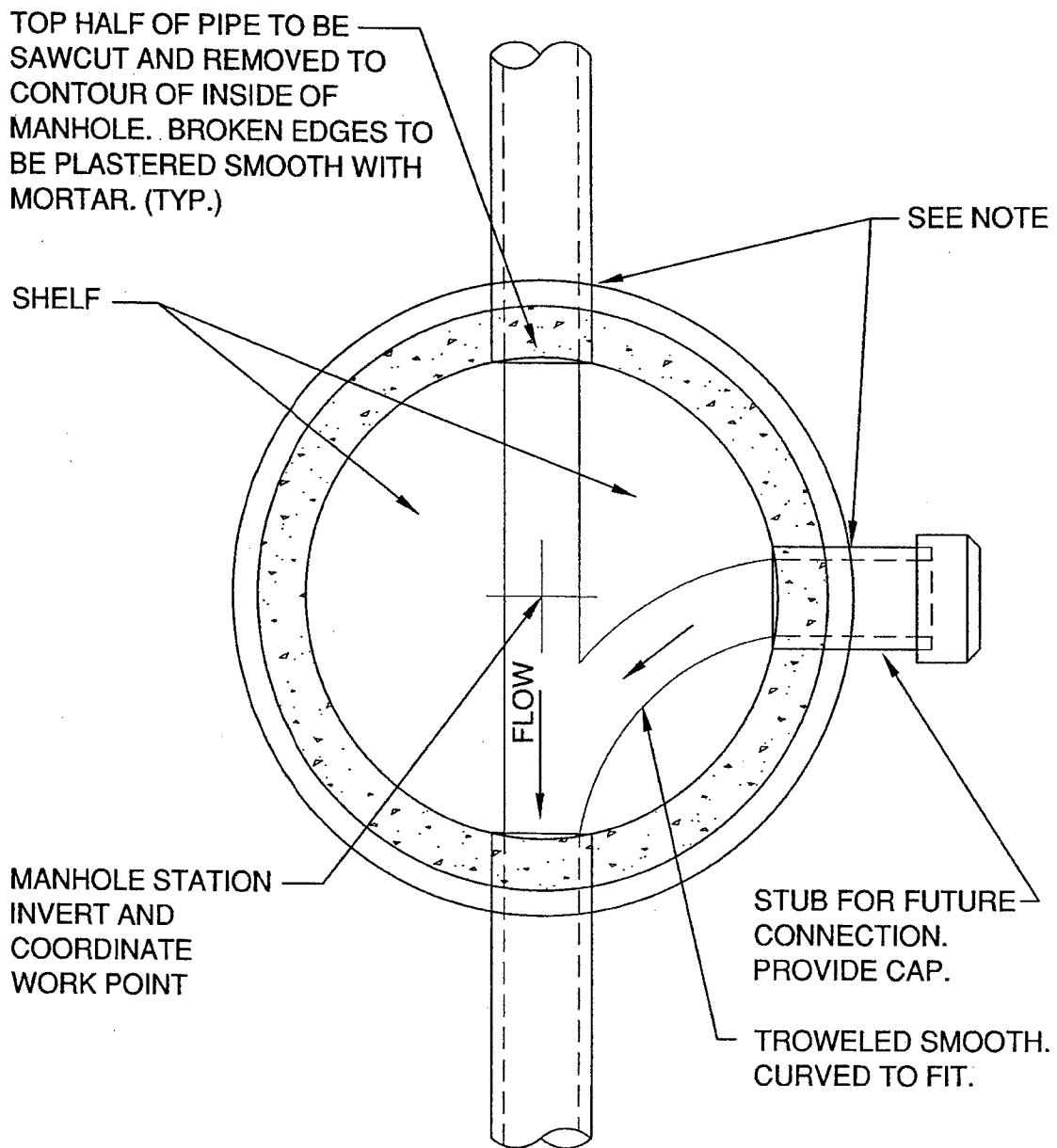
FLEXIBLE PIPE TO  
MANHOLE CONNECTOR  
FOR SANITARY SEWER  
PIPE.

TYPICAL  
CONNECTION

8" PRECAST  
CONCRETE BASE



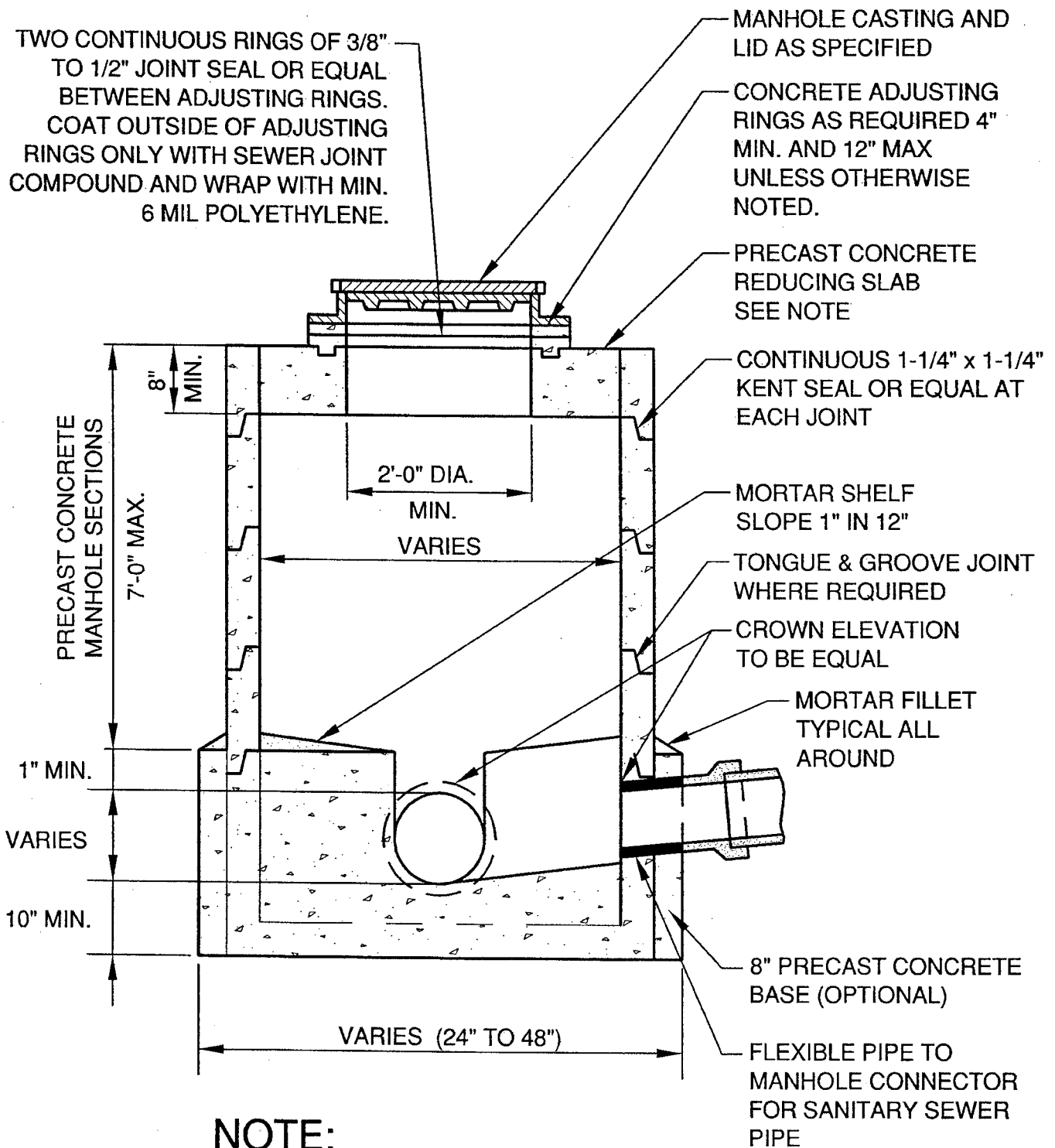
# **SANITARY AND STORM STANDARD MANHOLE 21" - 48" (INCLUSIVE)**



NOTE:  
FOR PVC PIPE PROVIDE AN APPROVED FLEXIBLE JOINT.

## MANHOLE BASE PLAN

### 8" - 48" (INCLUSIVE)

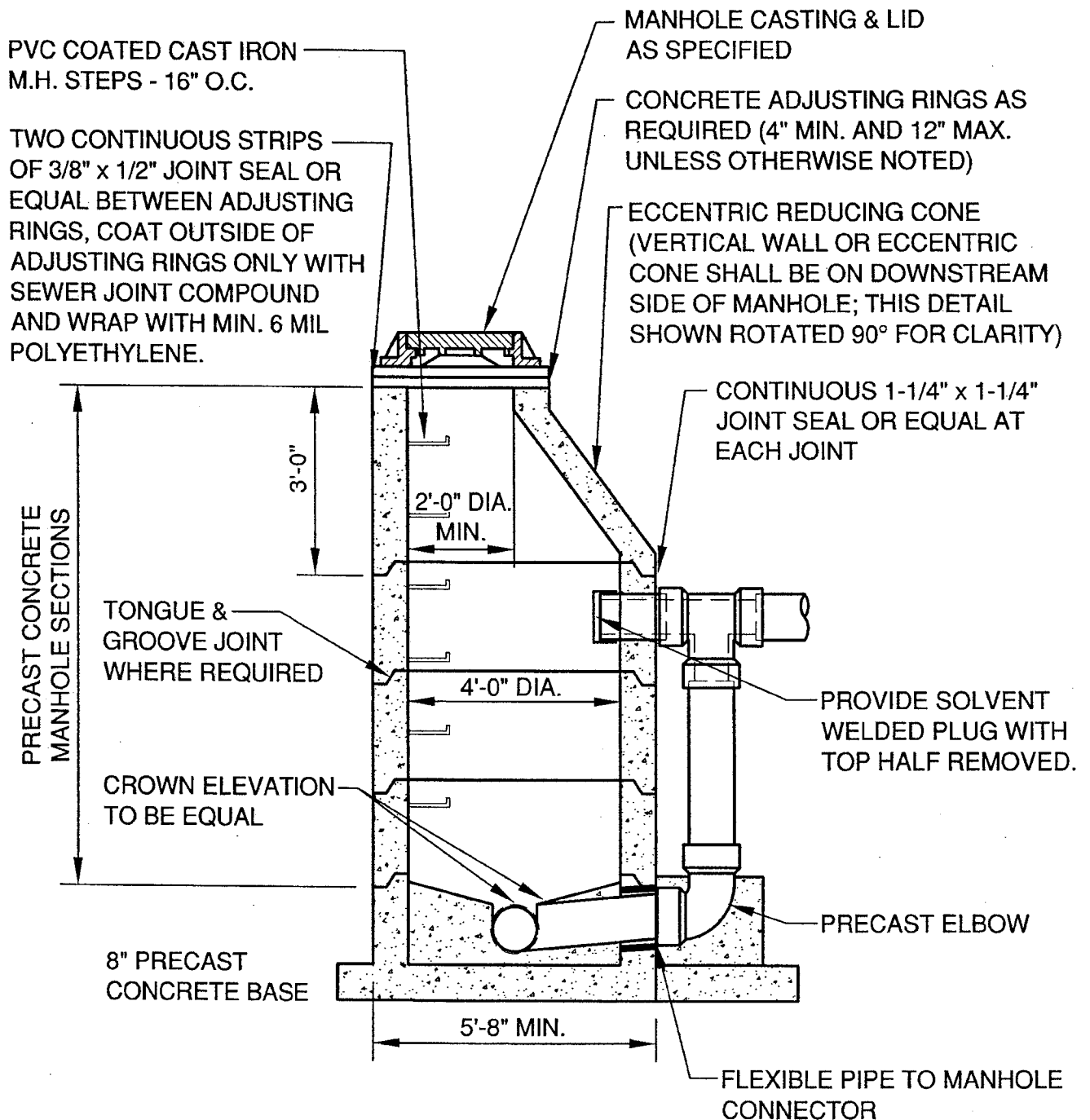


### NOTE:

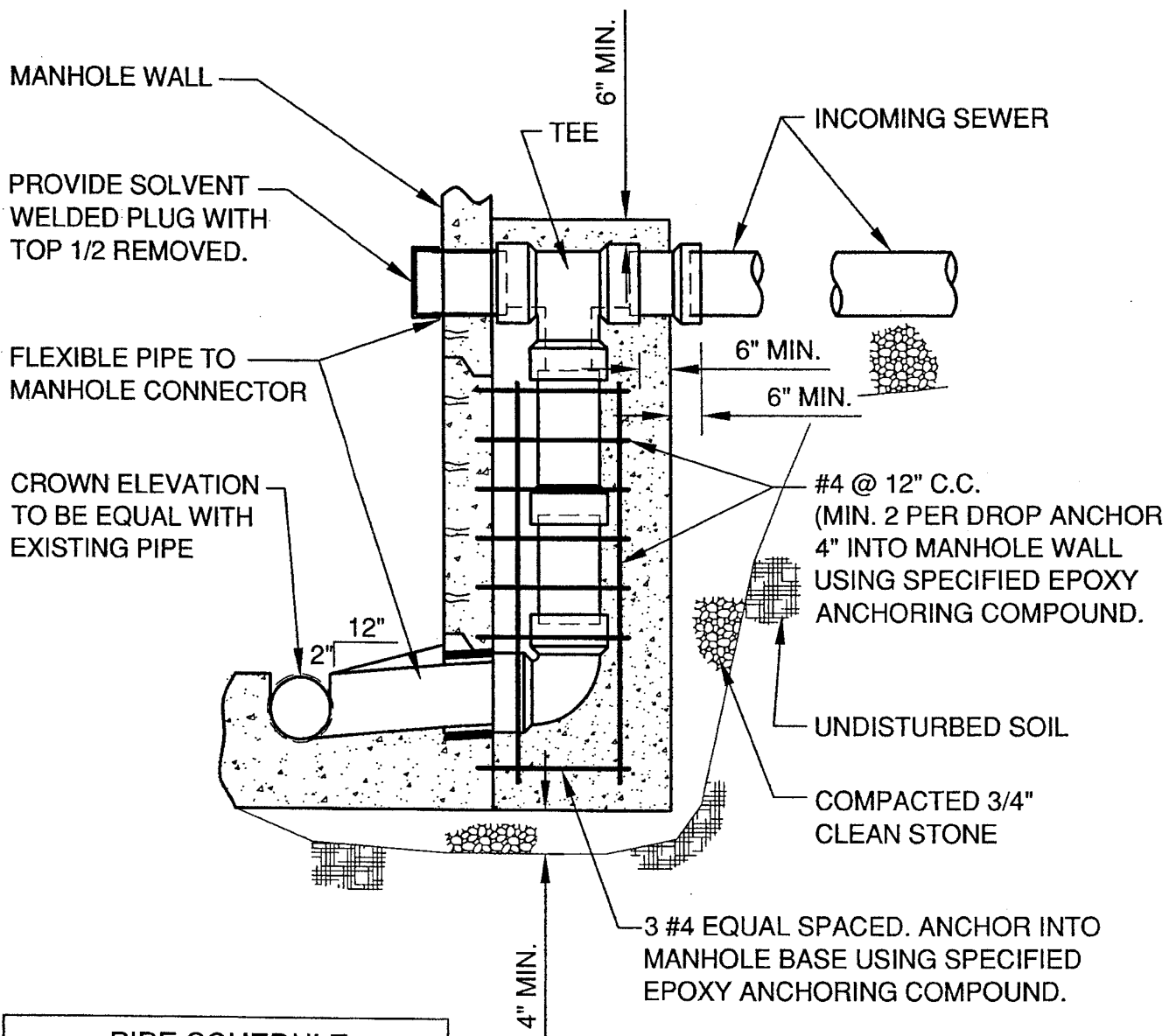
POSITION HOLE IN REDUCING SLAB ON DOWN STREAM SIDE OF MANHOLE

## LOW HEADROOM MANHOLE 24" - 48" (INCLUSIVE)



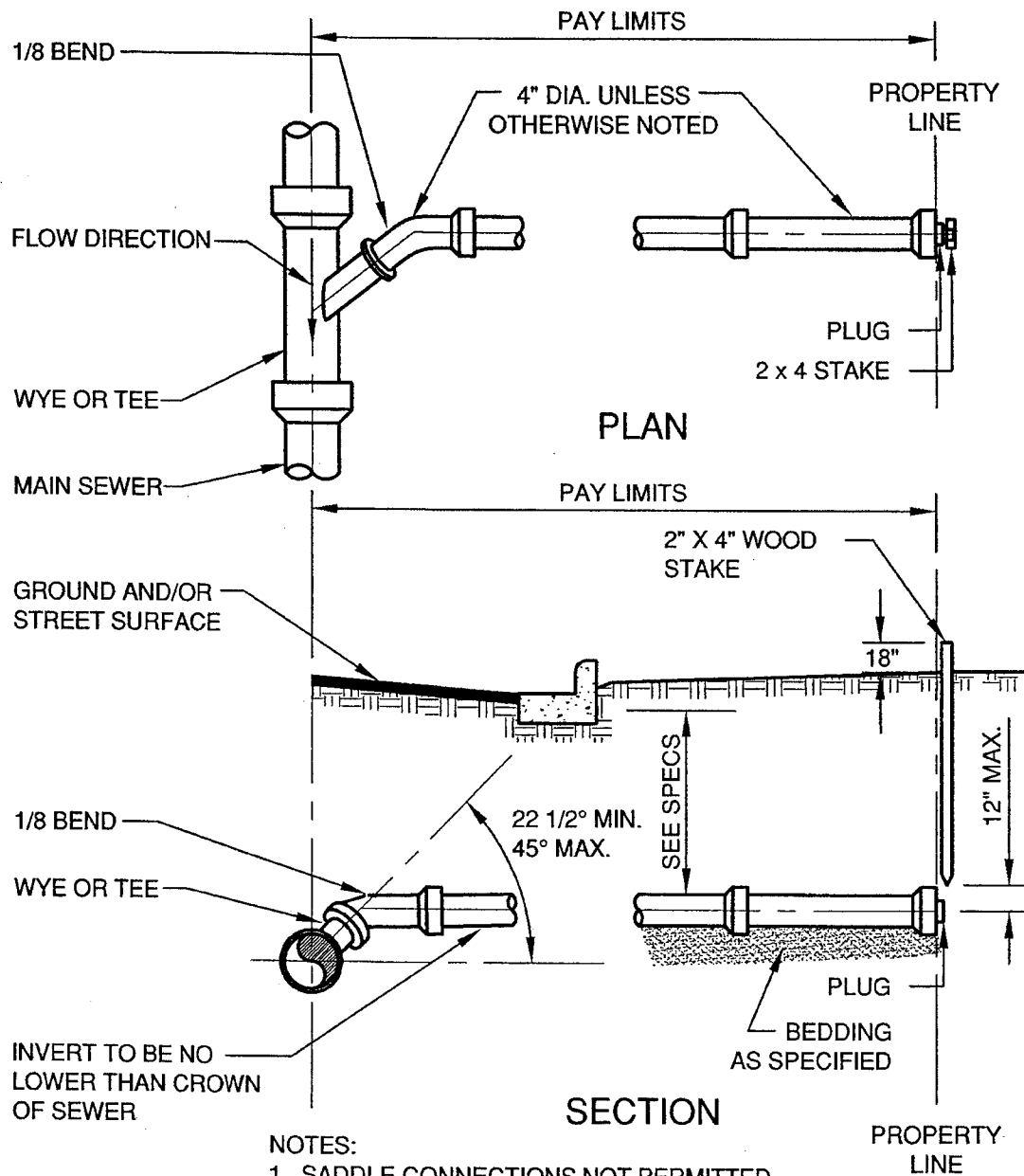


## STANDARD PRECAST DROP MANHOLE 8"-12" (INCLUSIVE)

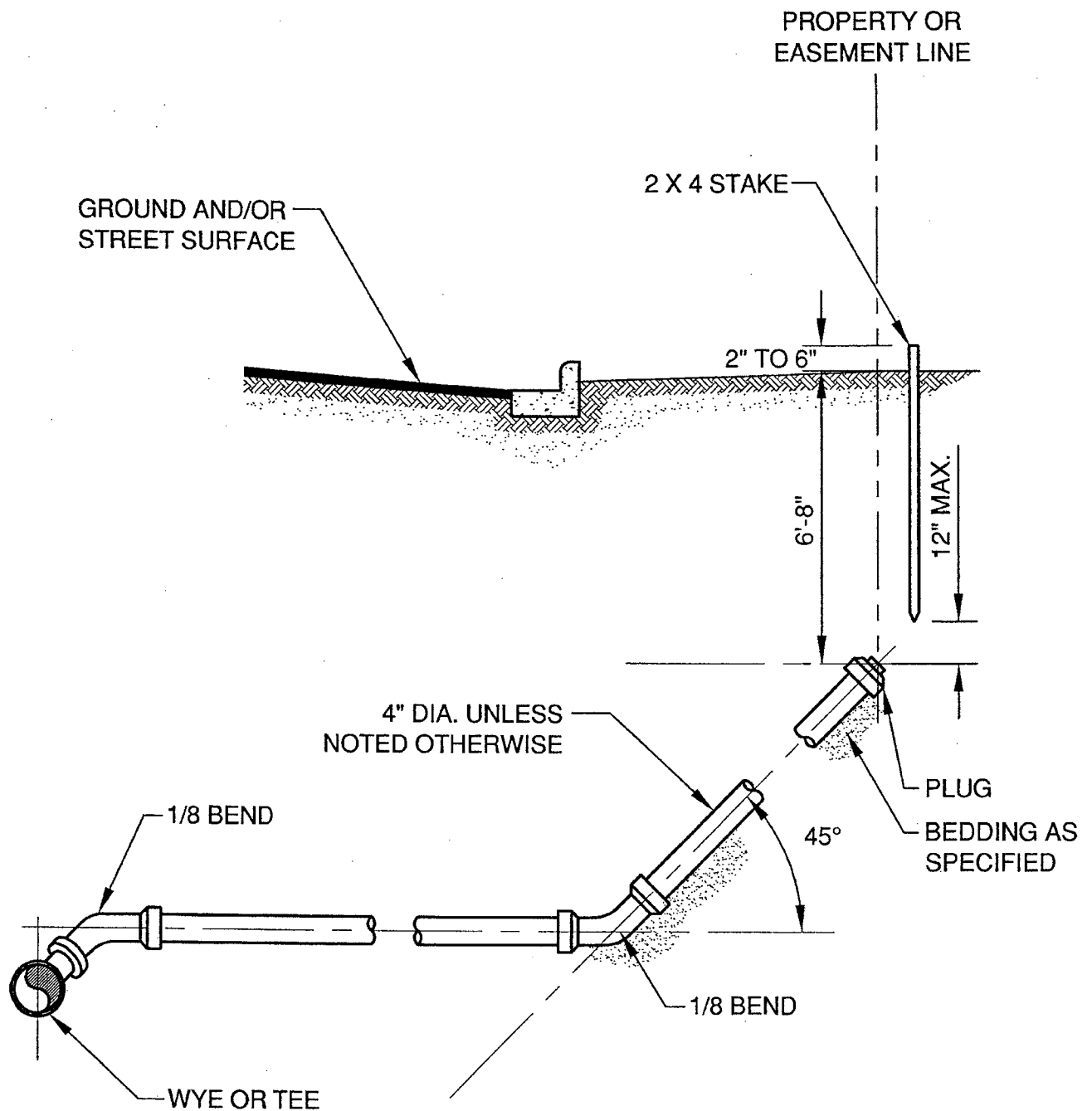


PIPE SCHEDULE OUTSIDE DROP MANHOLE	
INCOMING PIPE	DROP PIPE
24"	21"
21"	18"
18"	15"
15"	12"
12"	10"
10"	8"
8"	8"

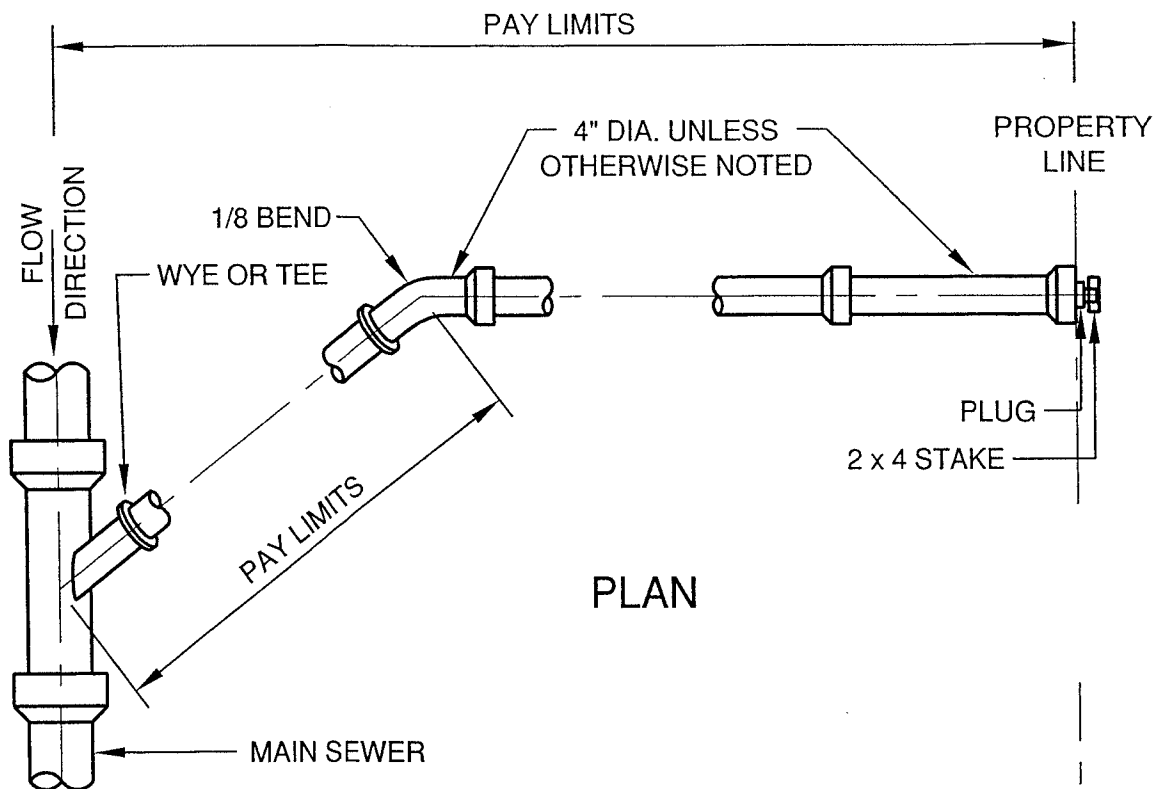
## FIELD CONSTRUCTED DROP MANHOLE



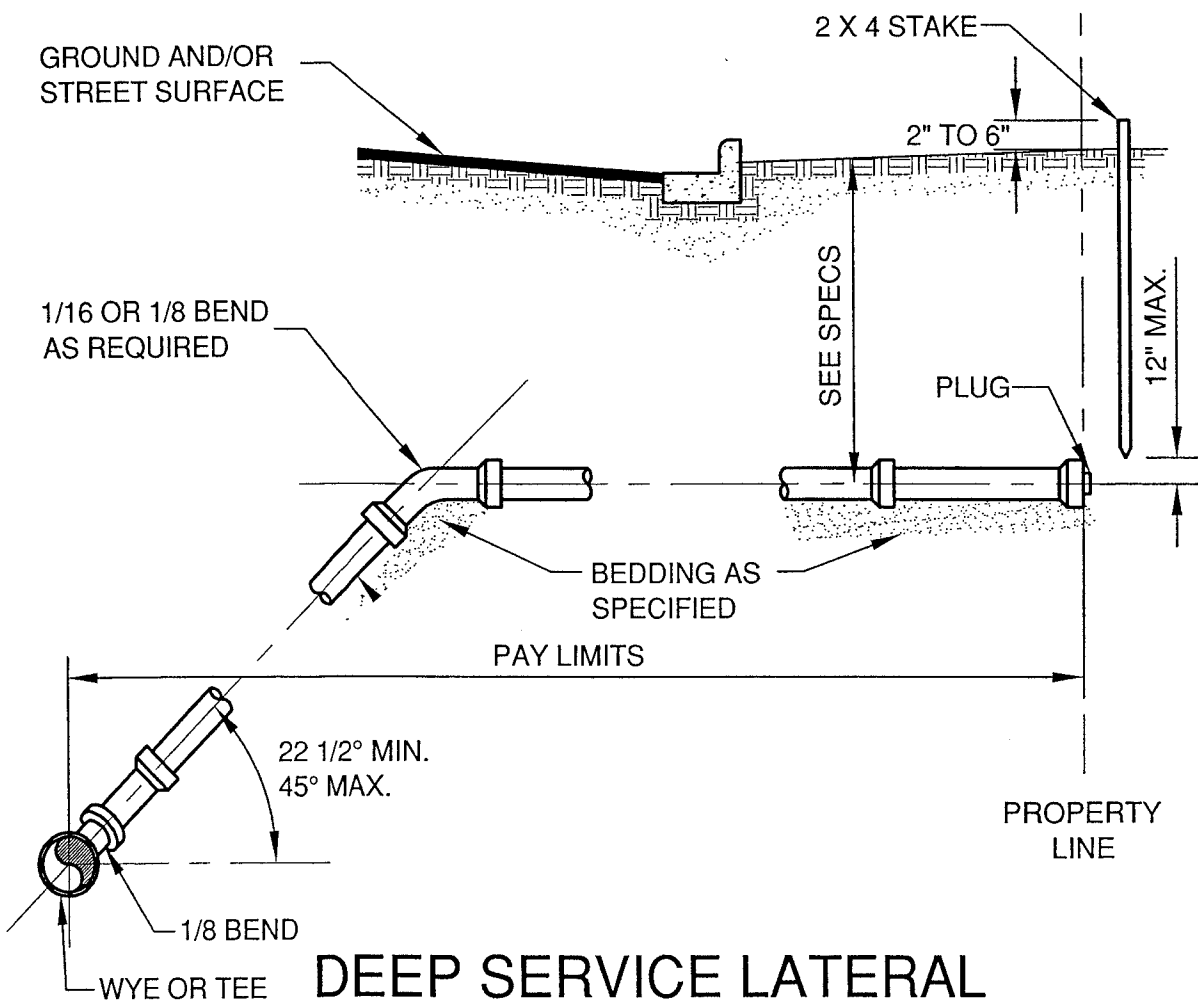
## STANDARD SERVICE LATERAL



STANDARD SERVICE LATERAL IN BEDROCK



## PLAN

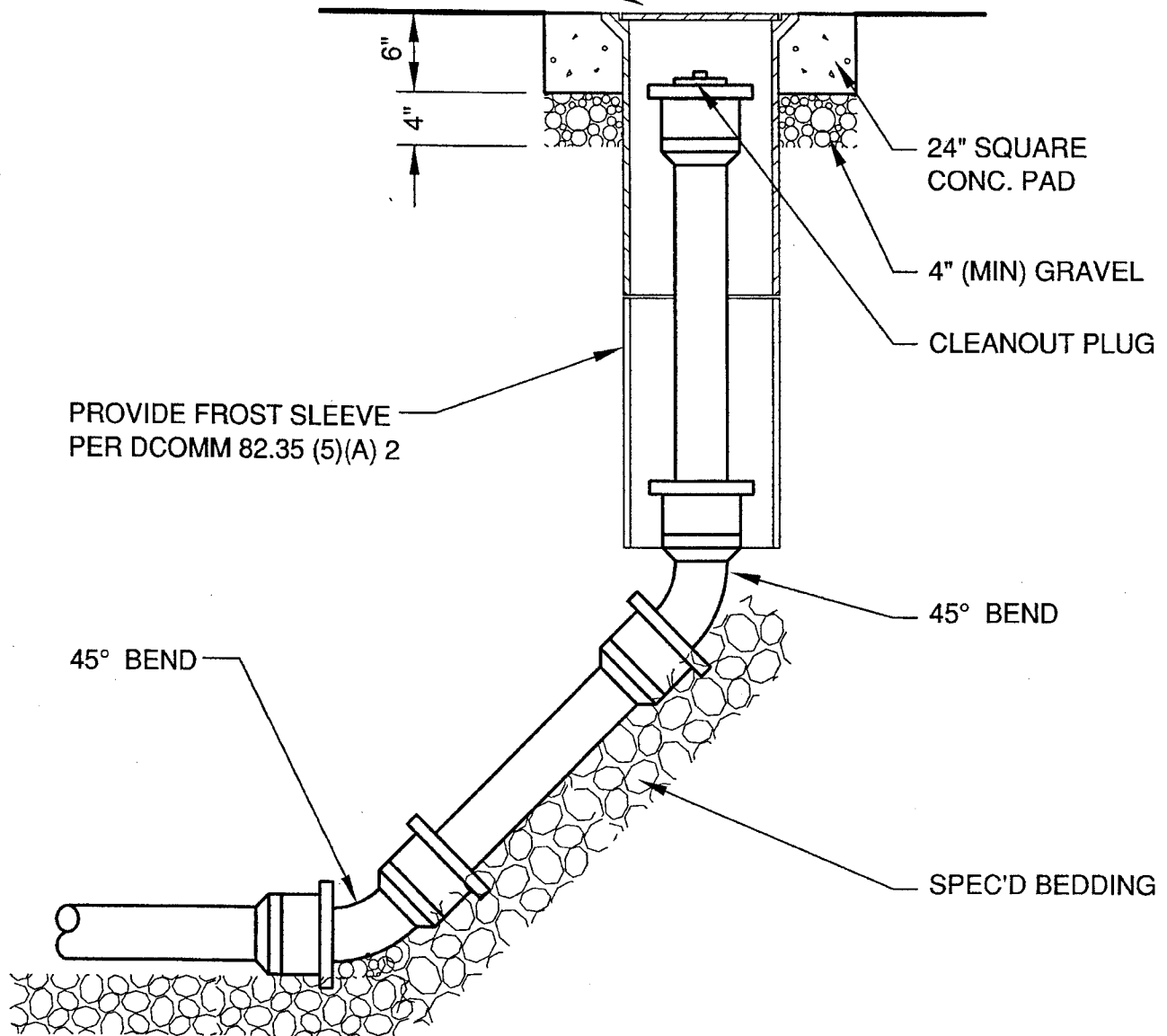


## DEEP SERVICE LATERAL

REVISED 10/17/06  
H:\DETAIL\1000\1007

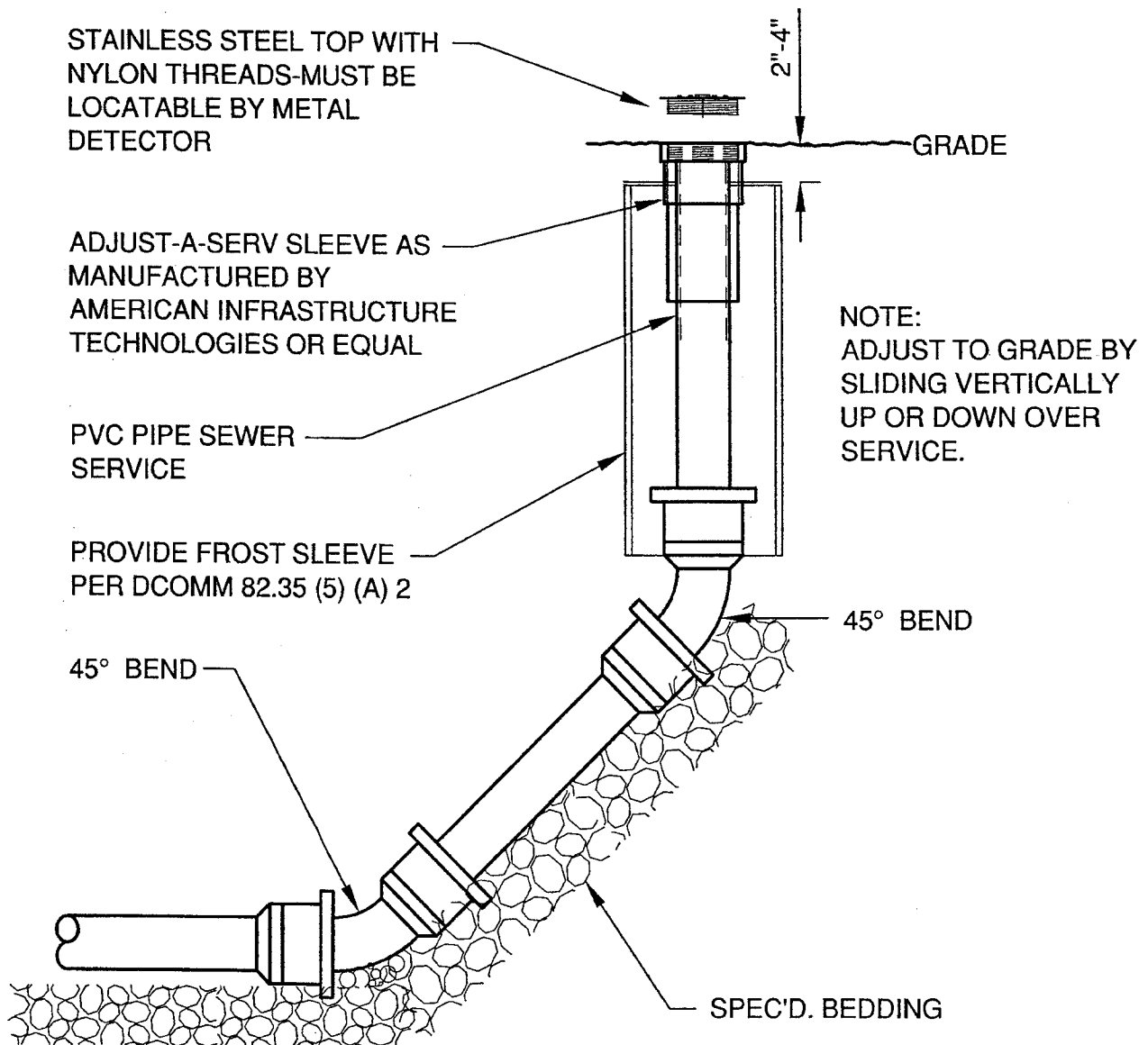
NOTE  
CLEANOUT LINE TO BE THE SAME  
SIZE & MATERIAL AS SEWER MAIN.

STANDARD CLEANOUT  
FRAME & COVER



CLEAN-OUT DETAIL  
(TRAVELED AREAS)

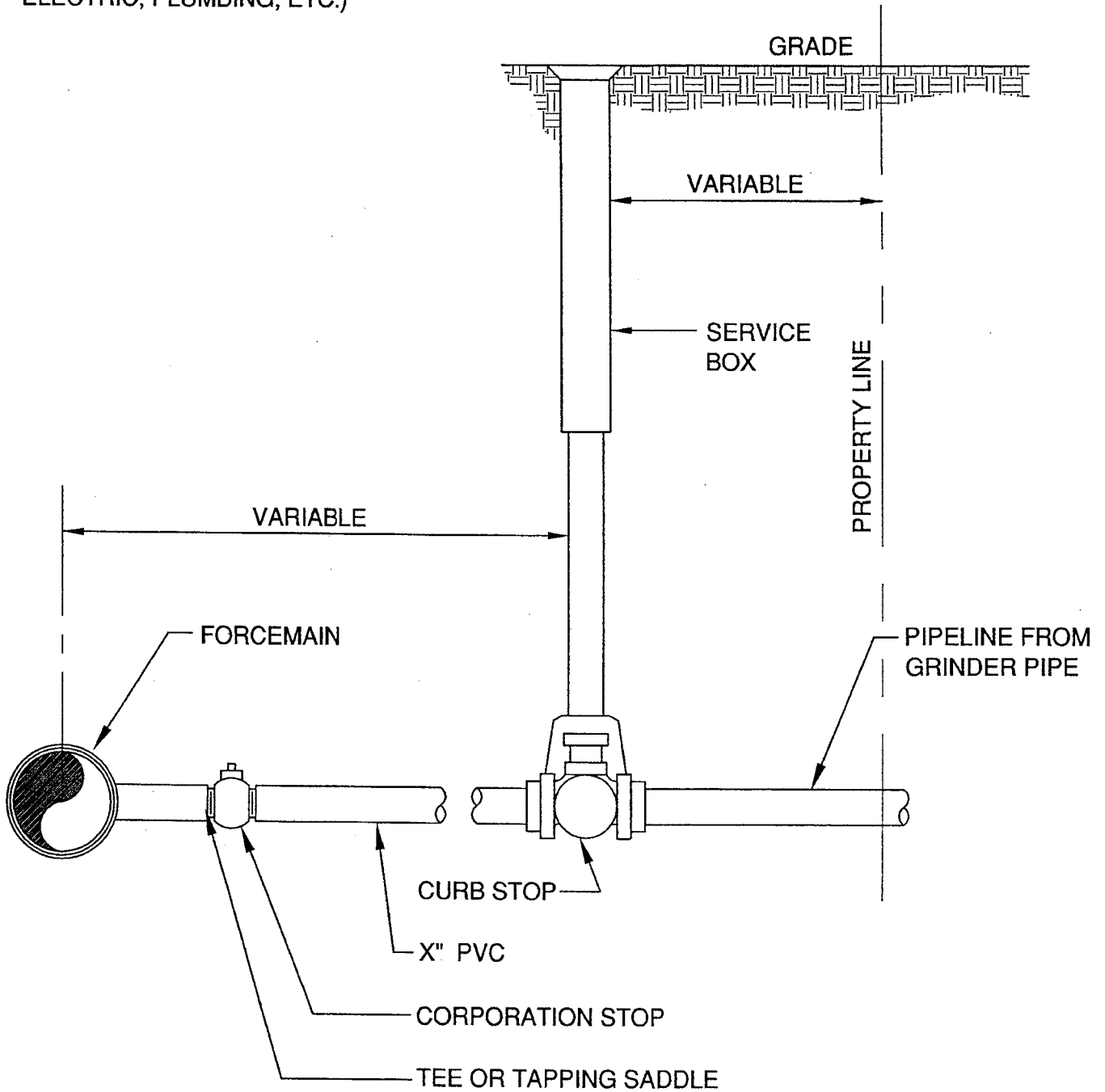
NOTE: CLEANOUT LINE TO BE THE  
SAME SIZE & MATERIAL AS SEWER MAIN



## CLEAN-OUT DETAIL (NON-TRAVELED AREAS)

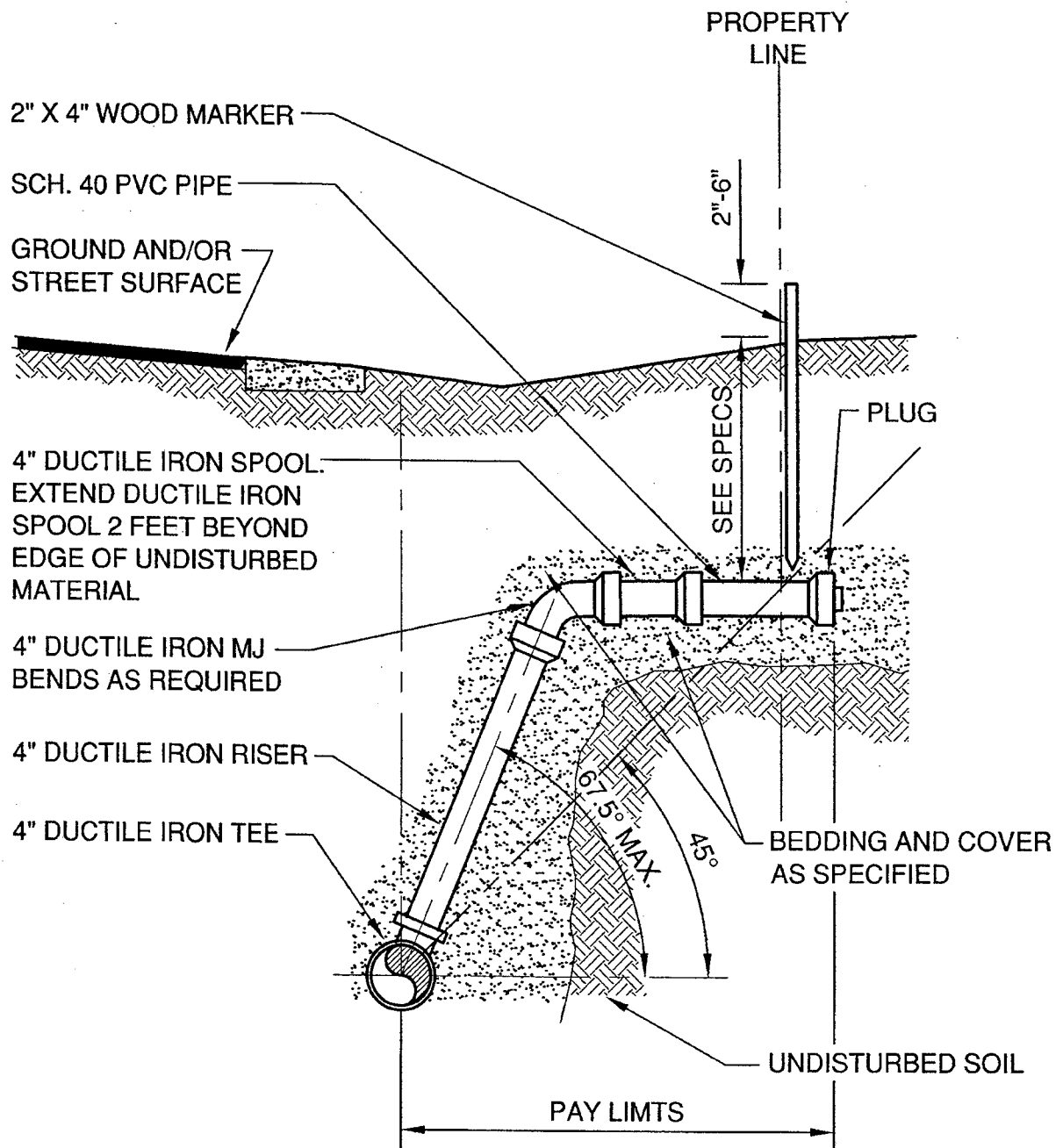
**NOTE:**

**INSTALLATION MUST CONFORM TO ALL APPLICABLE CODES. (BUILDING, ELECTRIC, PLUMBING, ETC.)**



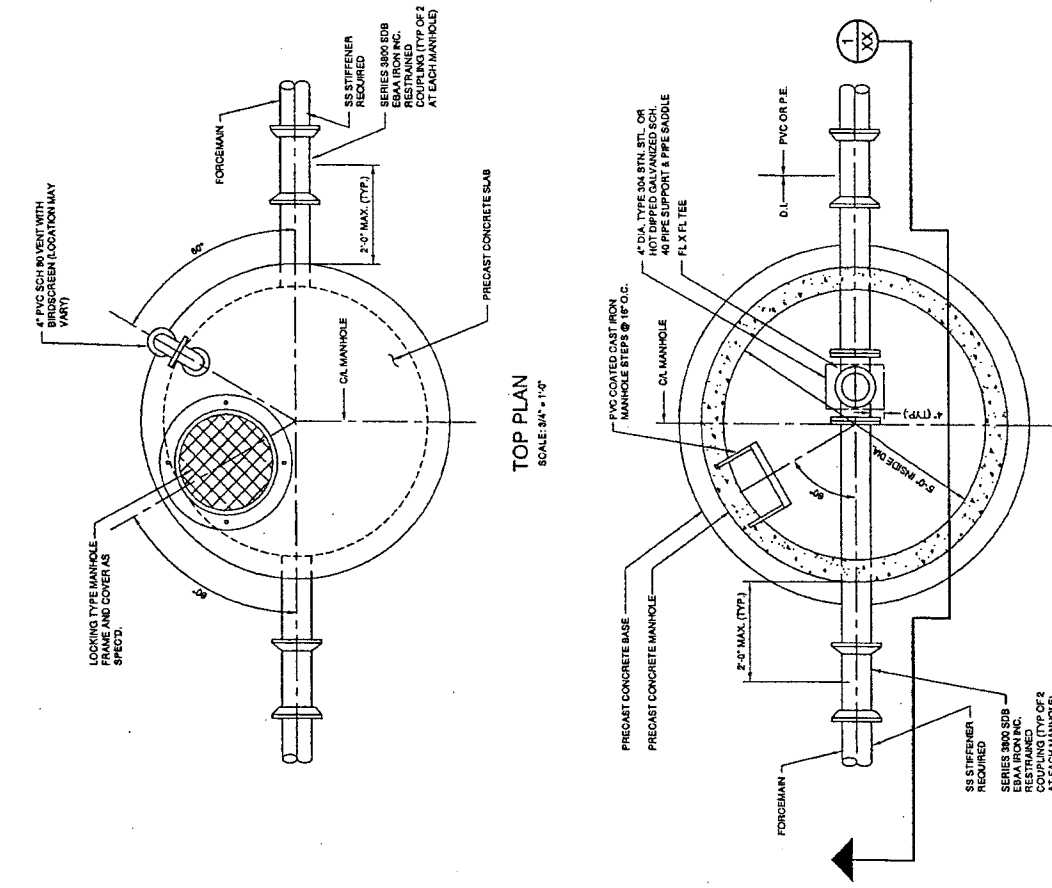
## DISCHARGE PIPING TO FORCEMAIN DETAIL





## OPTIONAL DEEP SERVICE LATERAL

45° TO 67.5° MAXIMUM ANGLE

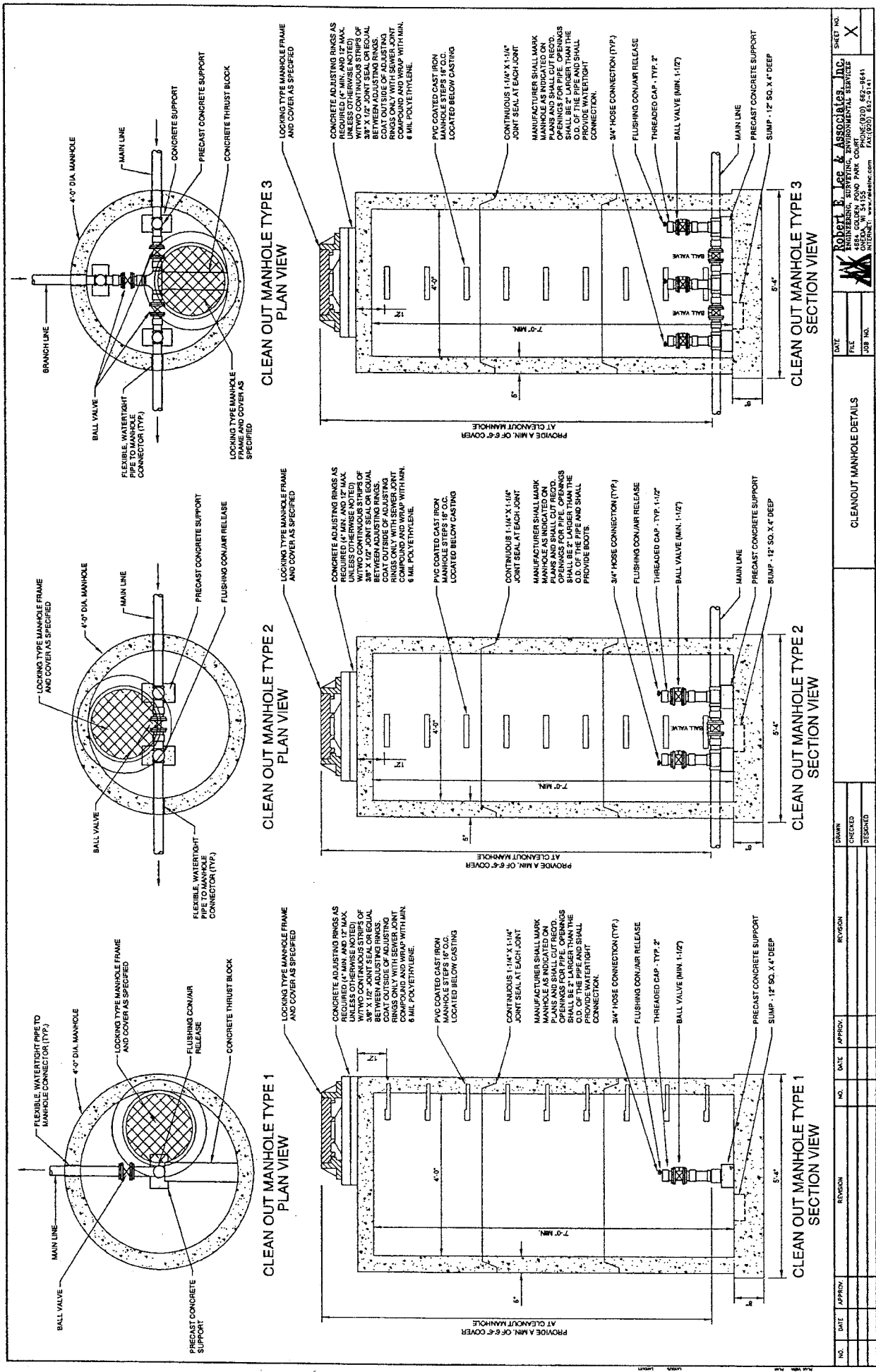


SECTION  
NTS

SECTIONAL BASE PLAN  
SCALE: 3/4" = 1'-0"

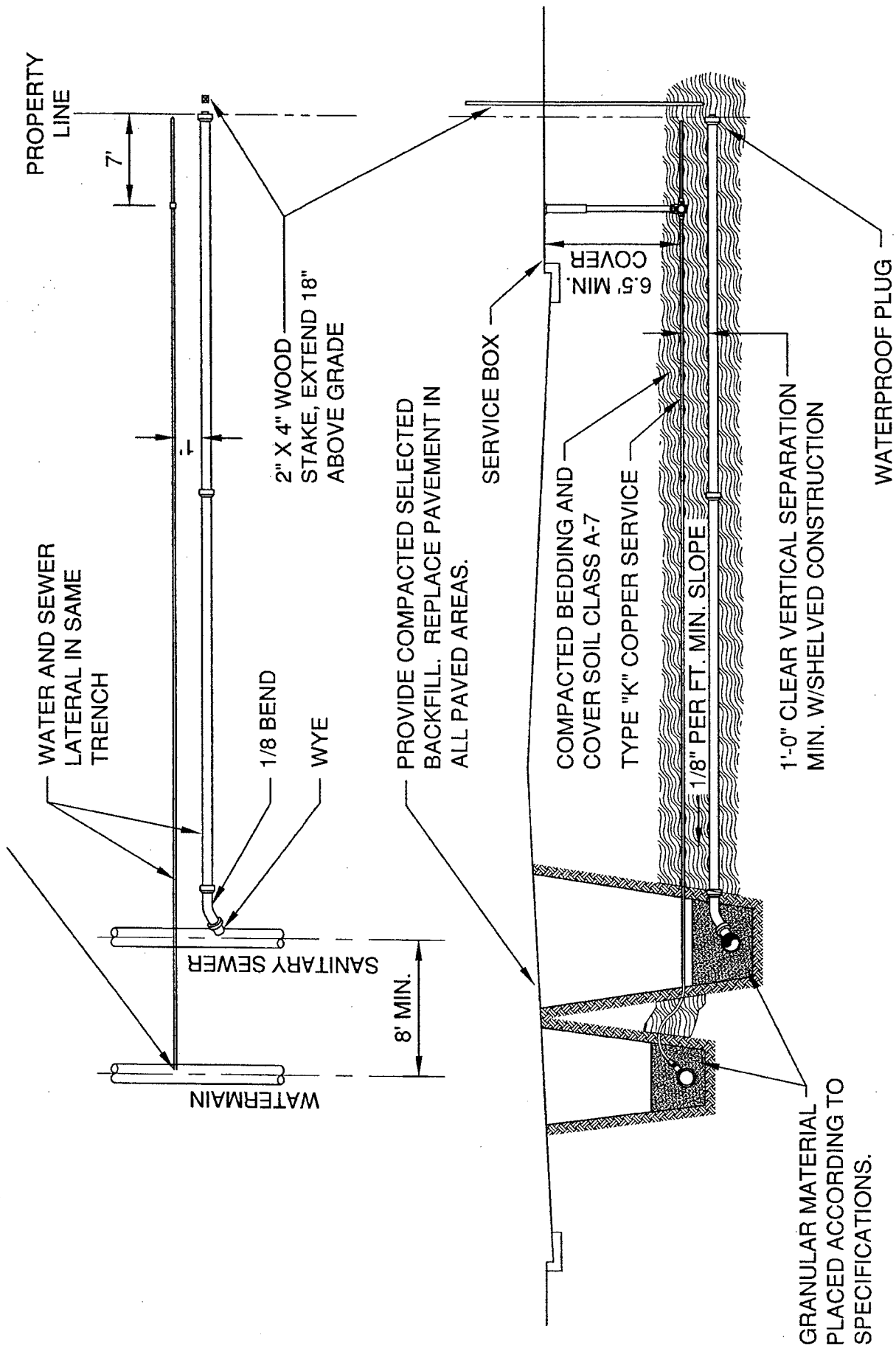
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**Robert E. Lee & Associates, Inc.**  
ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES  
4684 GOLDEN POND PARK COURT  
ONEIDA, WI 54155  
PHONE (920) 862-9841  
FAX (920) 862-9161  
WWW.leeinc.com

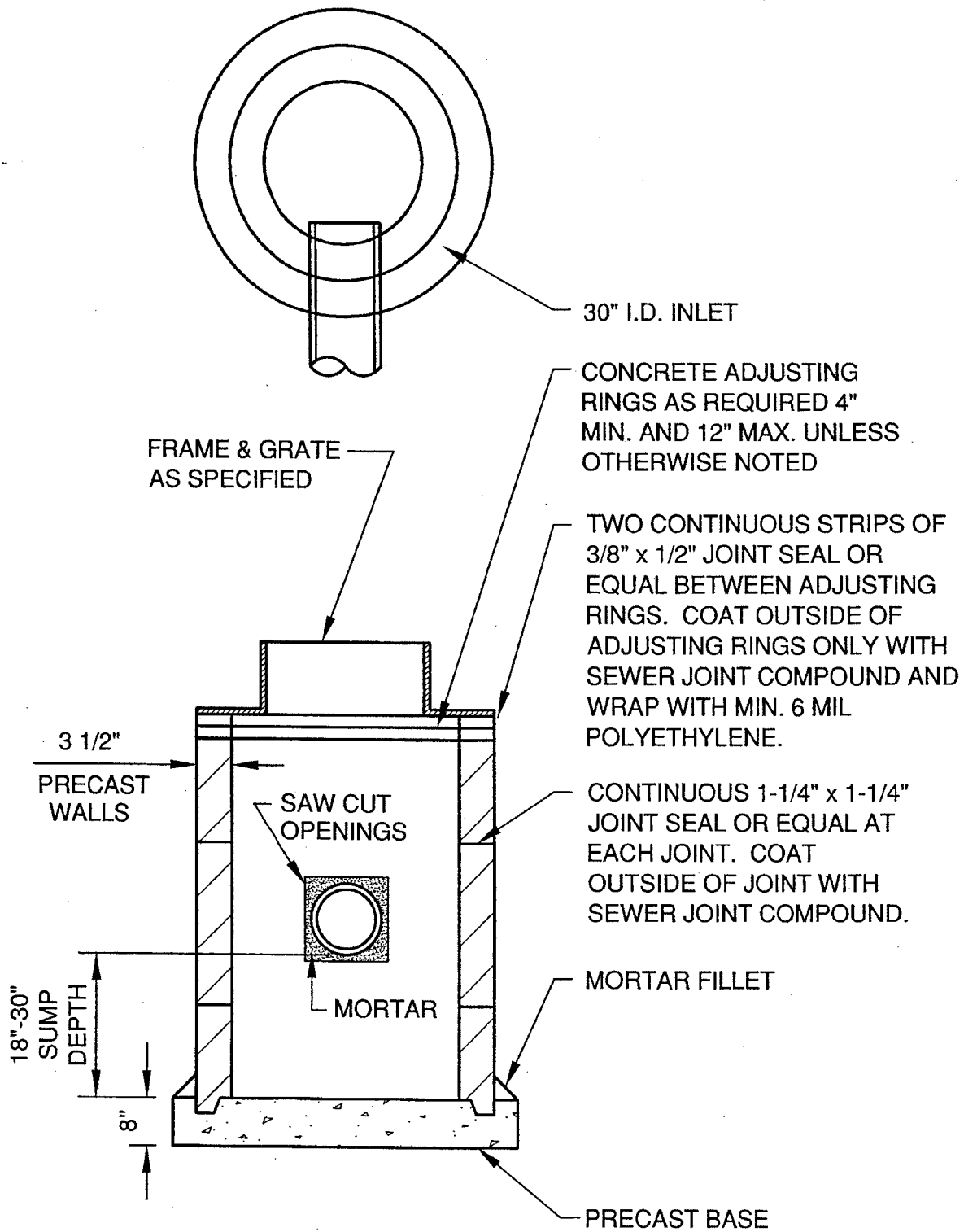


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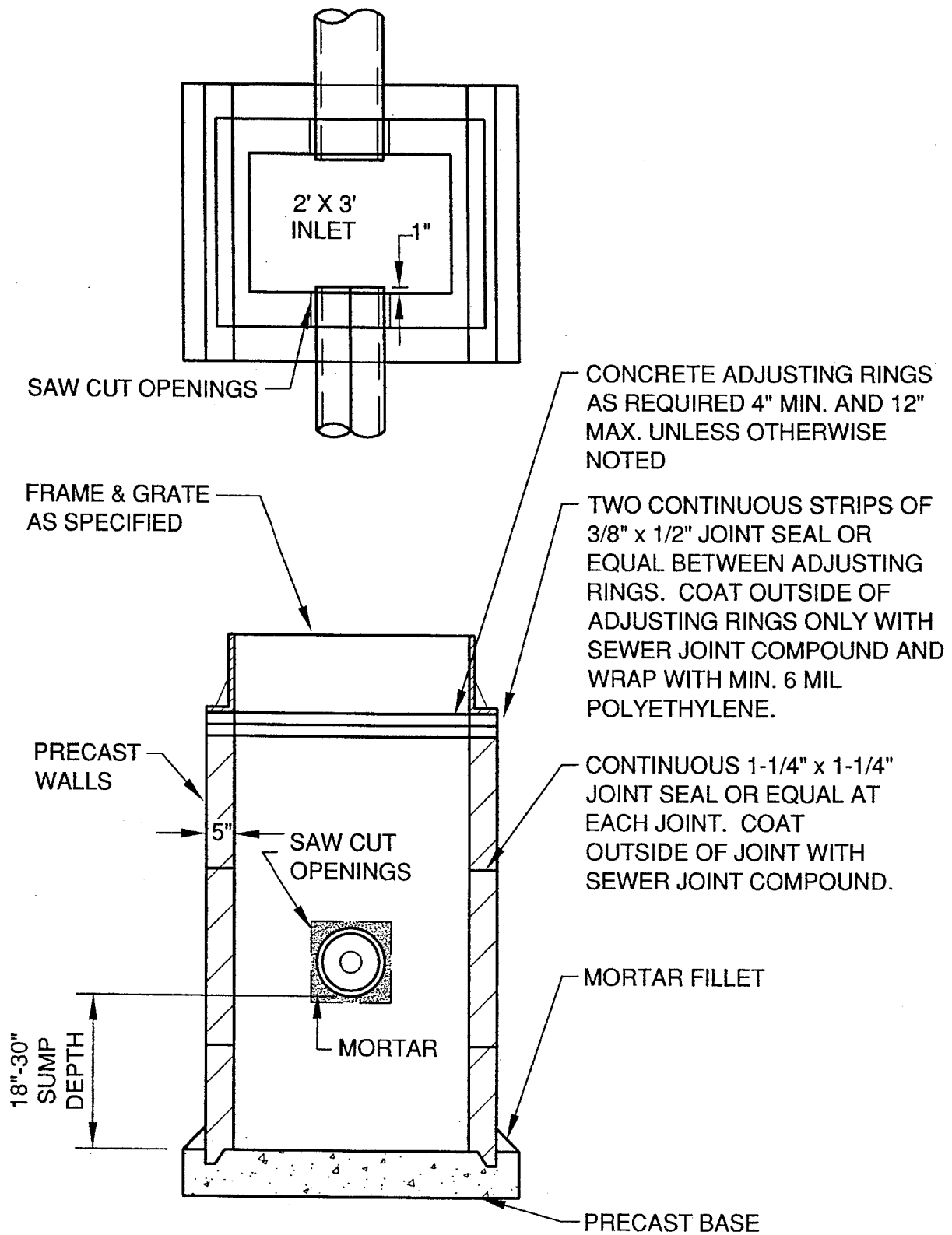
**Robert E. Lee & Associates, Inc.**  
 ENGINEERING SURVEYING ENVIRONMENTAL SERVICE  
 1000 PARK COUNTRY DRIVE, SUITE 100  
 DUNEDIN, FL 33515  
 PHONE (813) 882-9641  
 FAX (813) 882-9641  
 INTERNET: www.relee.com



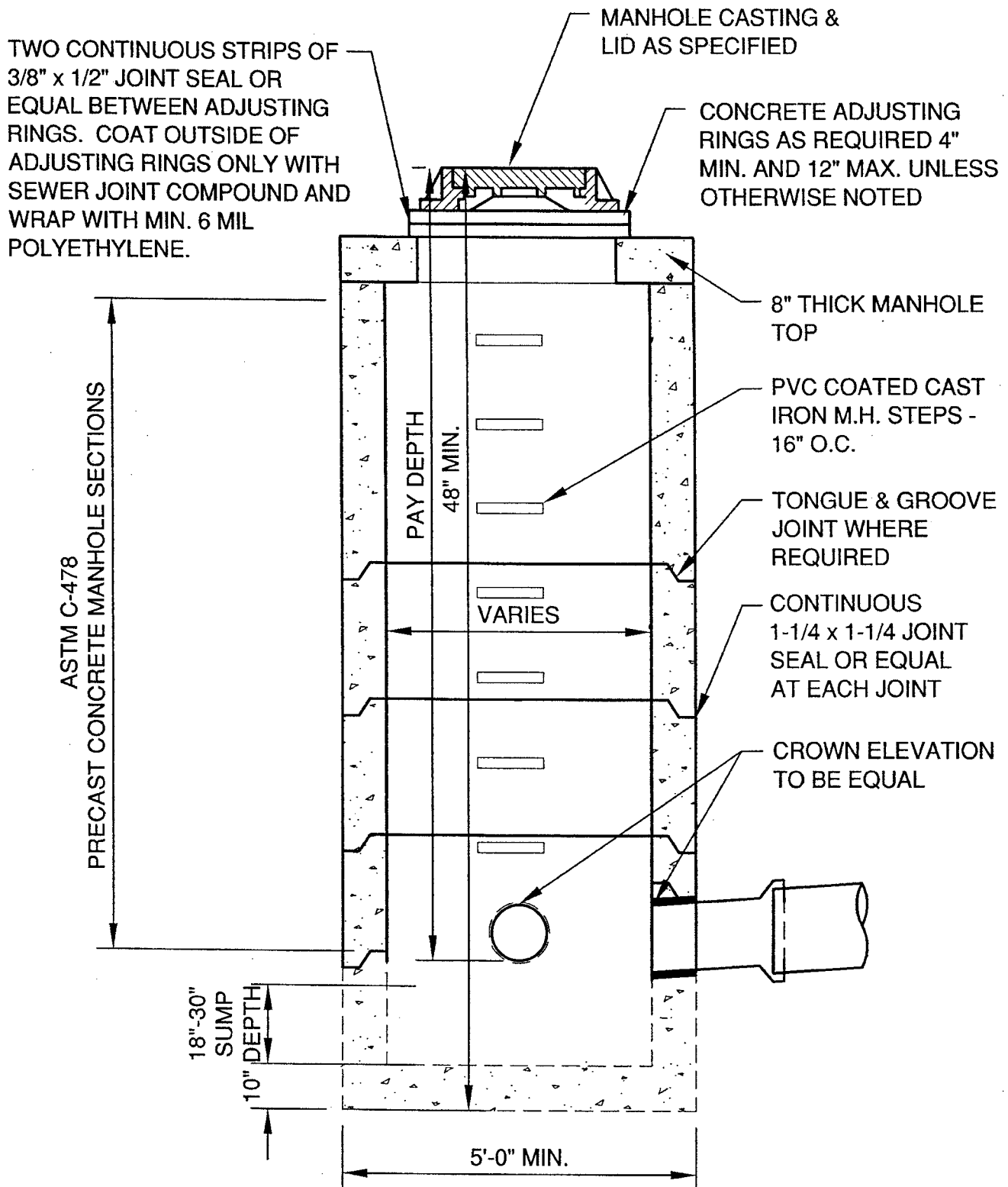
TYPICAL CONNECTION SEWER & WATER



TYPE 'A' STORM INLET



TYPE 'B' STORM INLET



STORM MANHOLE INLET  
 TYPE "A"

TWO CONTINUOUS STRIPS OF 3/8" x 1/2" JOINT SEAL OR EQUAL BETWEEN ADJUSTING RINGS. COAT OUTSIDE OF ADJUSTING RINGS ONLY WITH SEWER JOINT COMPOUND AND WRAP WITH MIN. 6 MIL POLYETHYLENE.

MANHOLE CASTING AND LID AS SPECIFIED

CONCRETE ADJUSTING RINGS AS REQUIRED (4" MIN. AND 12" MAX. UNLESS OTHERWISE NOTED)

PRECAST CONCRETE REDUCING SLAB SEE NOTE

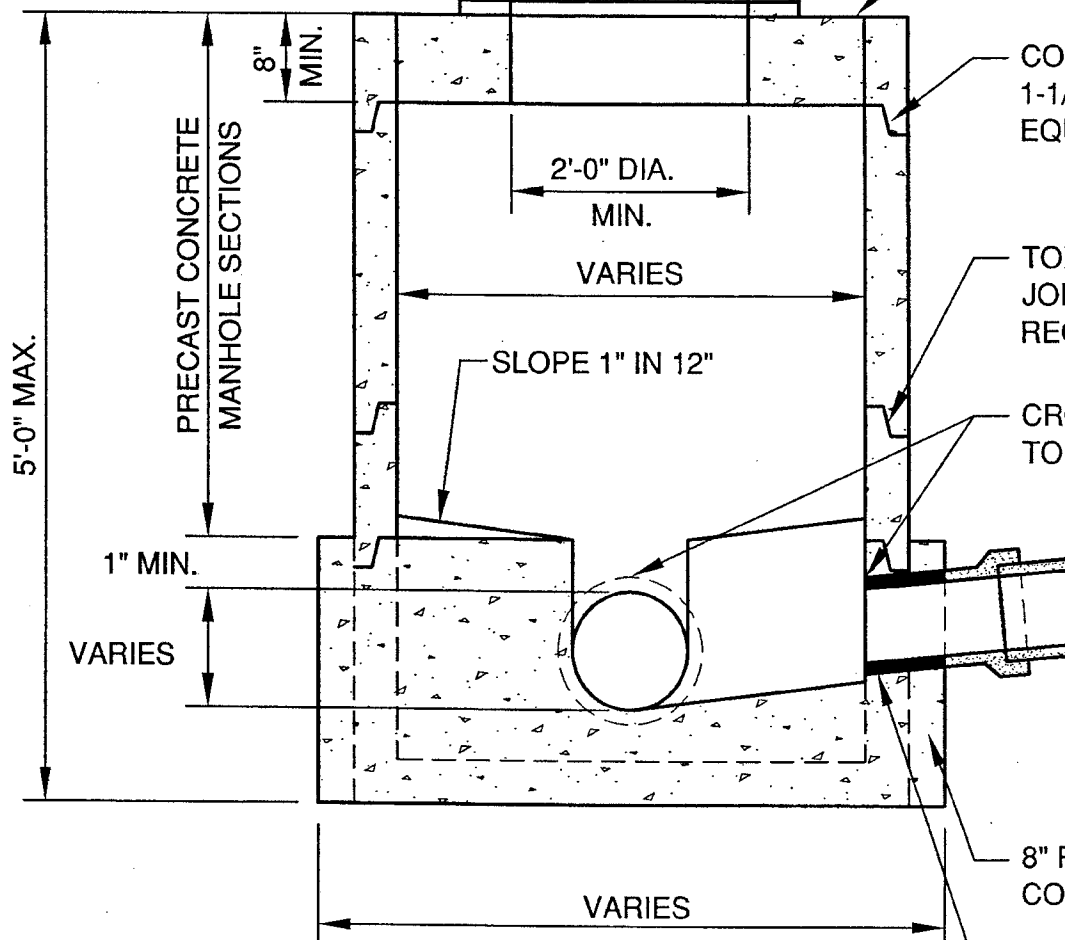
CONTINUOUS 1-1/4" x 1-1/4" JOINT SEAL OR EQUAL AT EACH JOINT.

TONGUE & GROOVE JOINT WHERE REQUIRED

CROWN ELEVATION TO BE EQUAL

8" PRECAST CONCRETE BASE

FLEXIBLE PIPE TO MANHOLE CONNECTOR FOR SANITARY SEWER PIPE

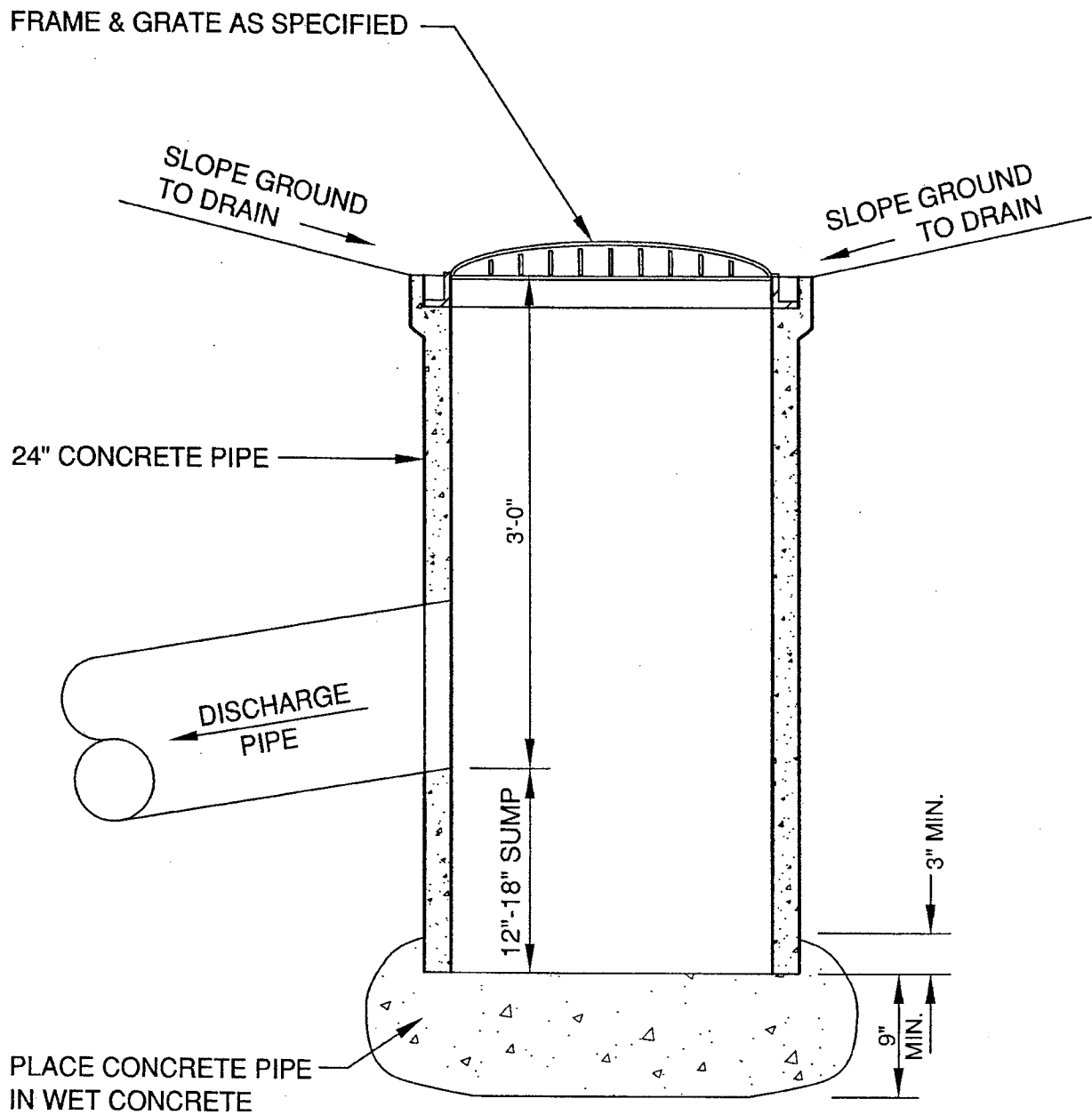


## NOTE

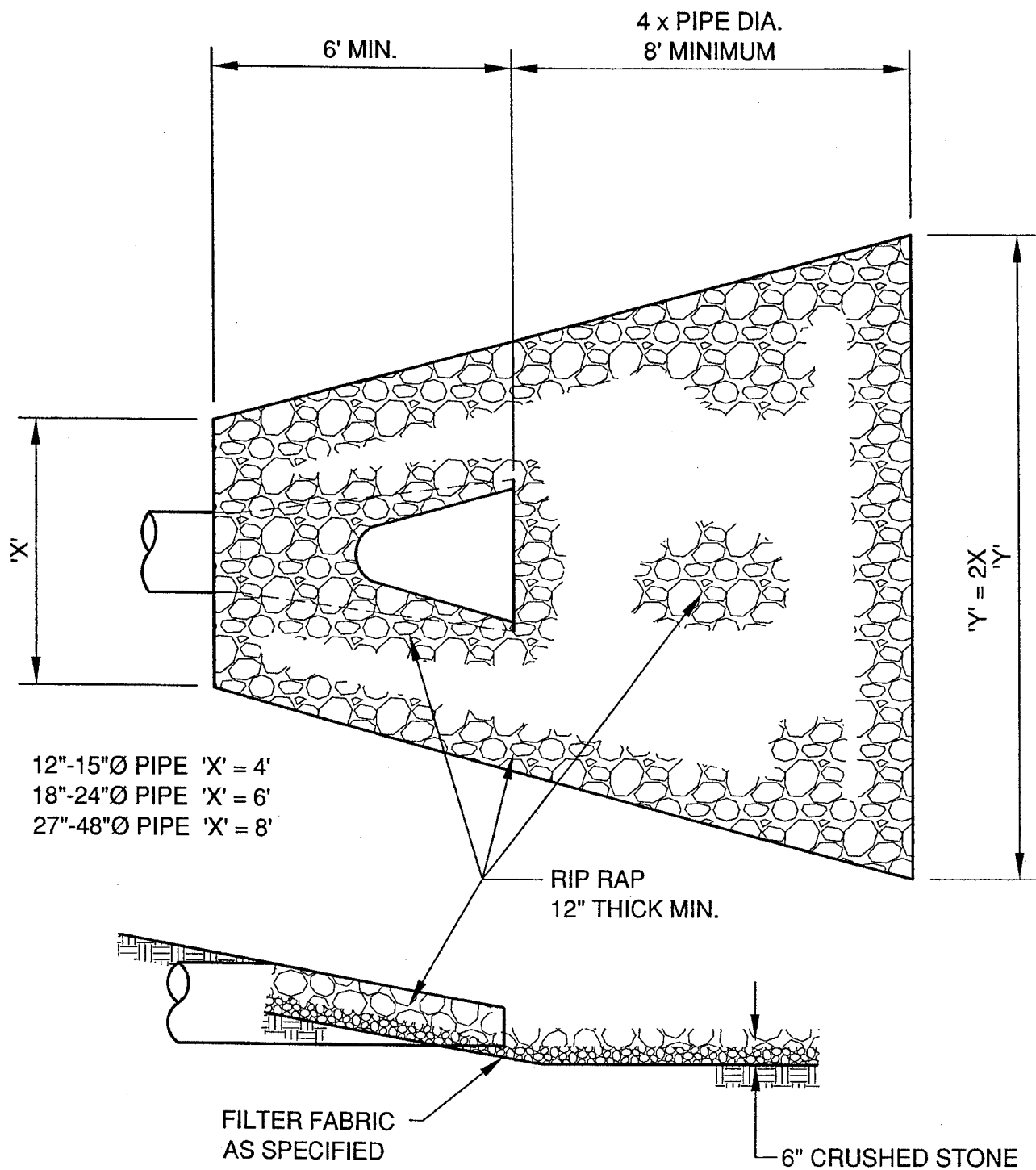
POSITION HOLE IN REDUCING SLAB ON DOWNSTREAM SIDE OF MANHOLE

# FLAT COVER MANHOLE

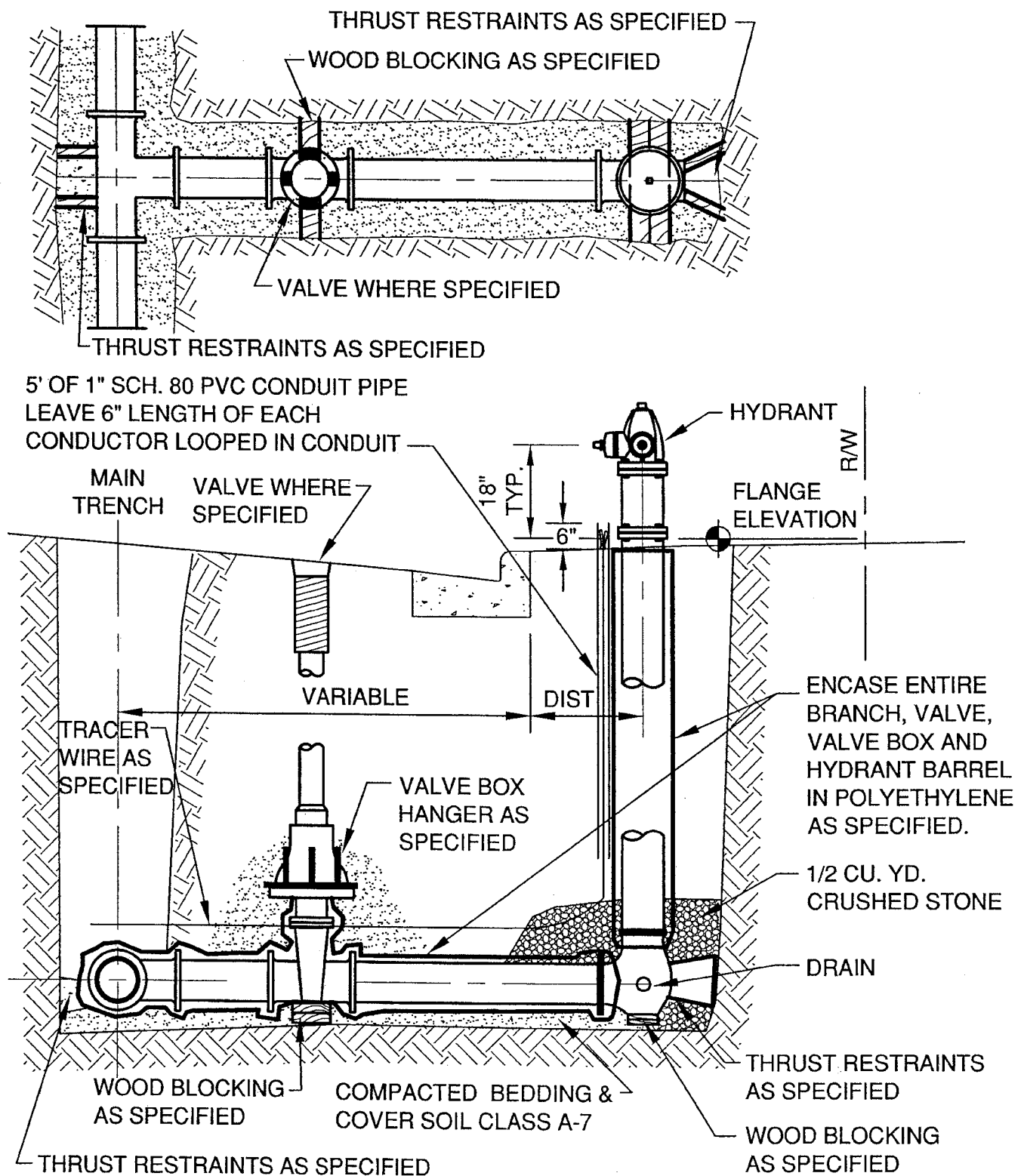




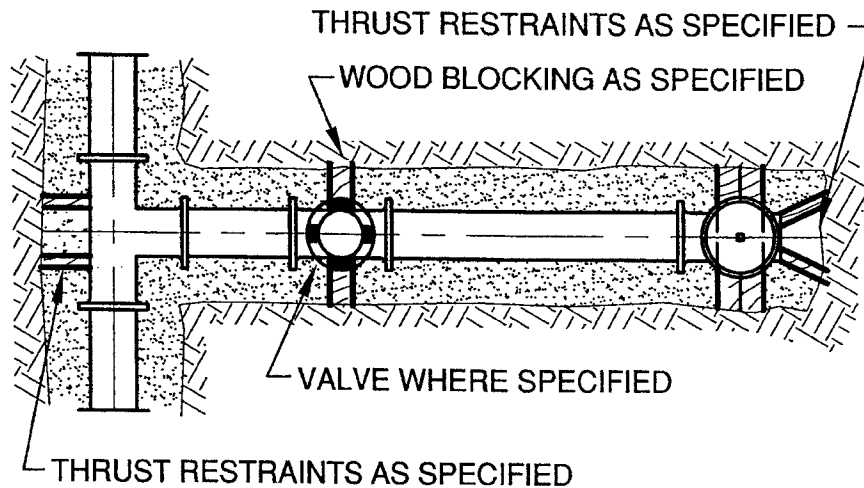
TYPICAL YARD DRAIN WITH SUMP



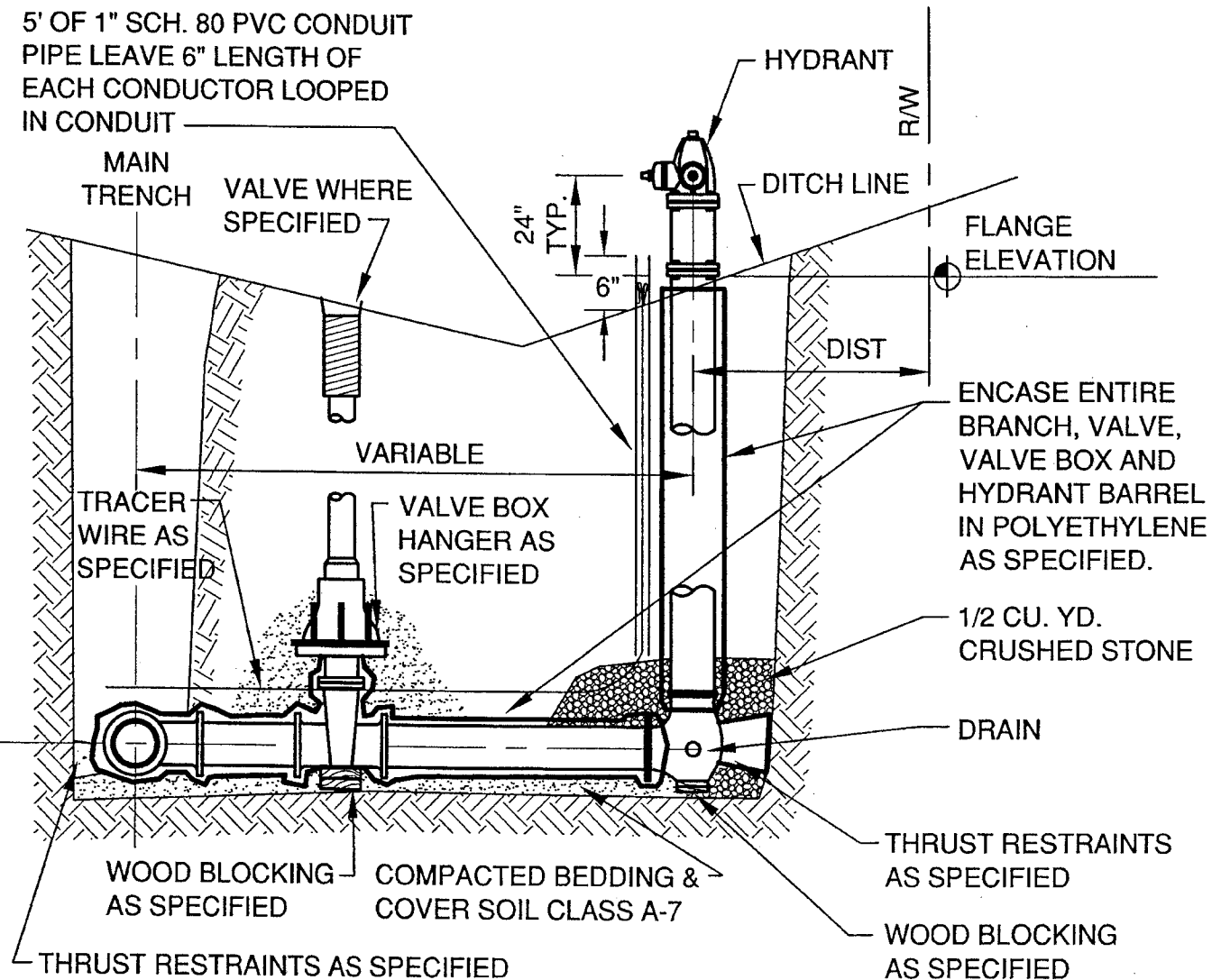
ENDWALL RIP RAP DETAIL



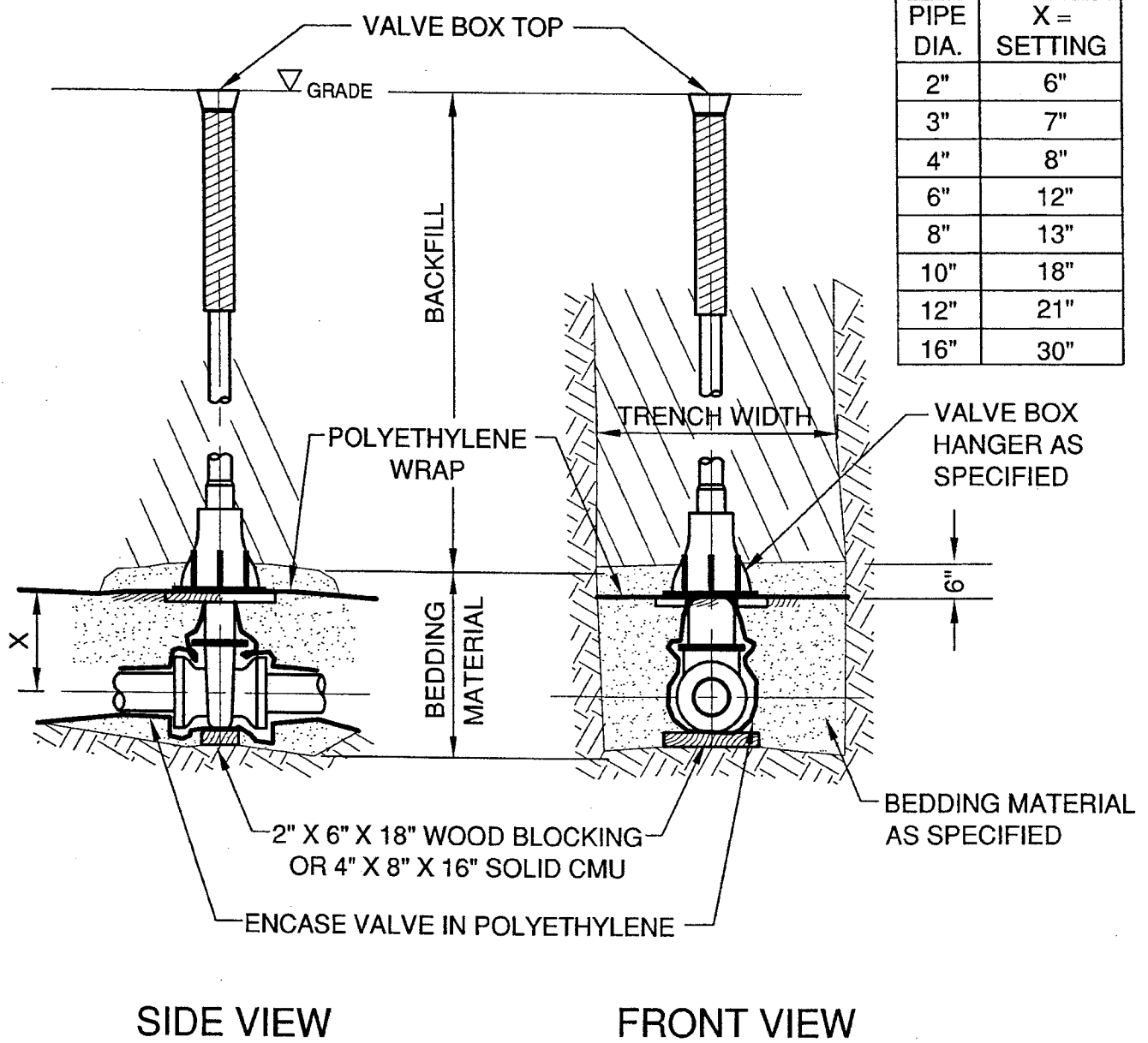
## STANDARD HYDRANT SETTING CURB SECTION



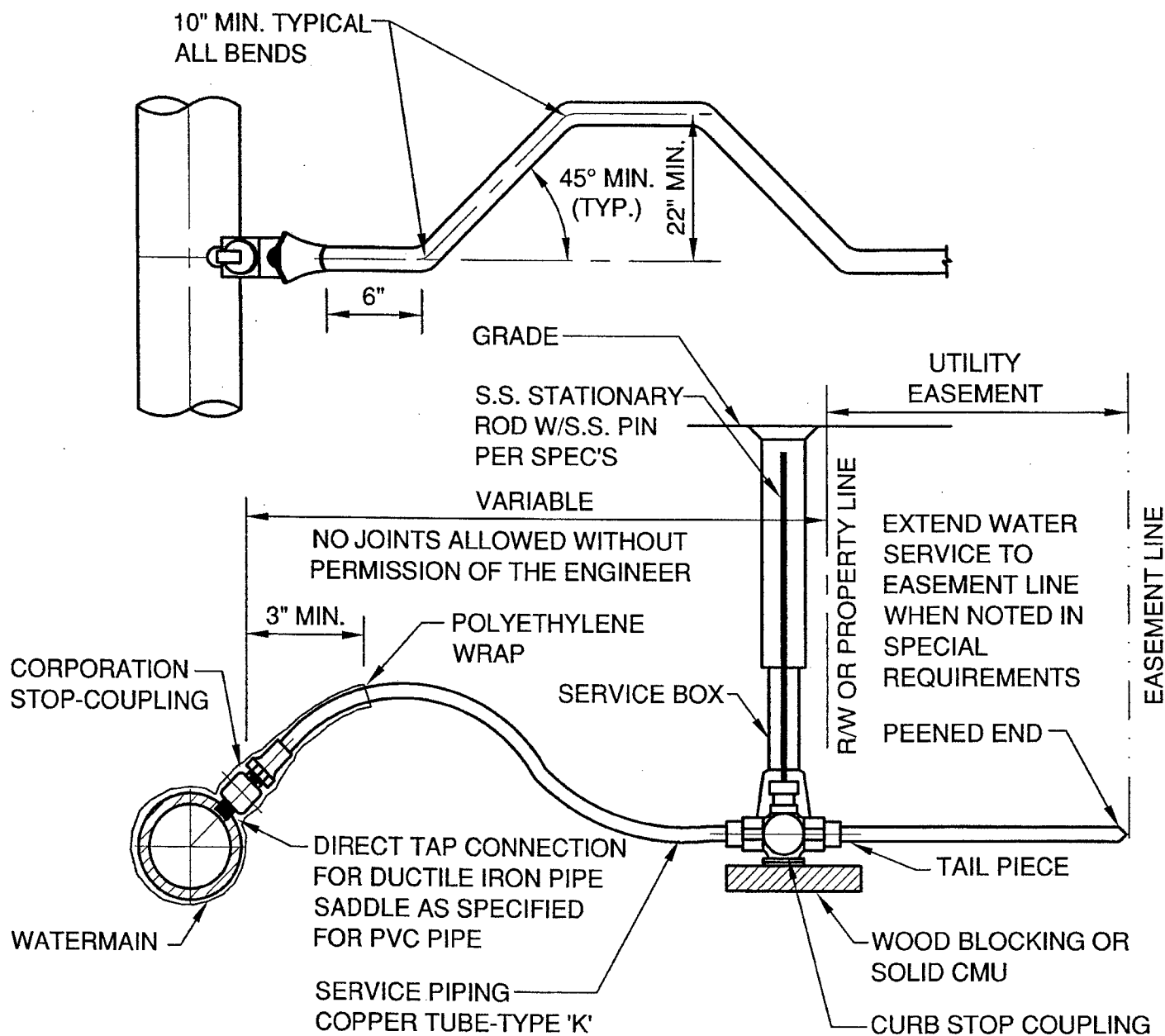
5' OF 1" SCH. 80 PVC CONDUIT  
PIPE LEAVE 6" LENGTH OF  
EACH CONDUCTOR LOOPED  
IN CONDUIT



## STANDARD HYDRANT SETTING DITCH SECTION



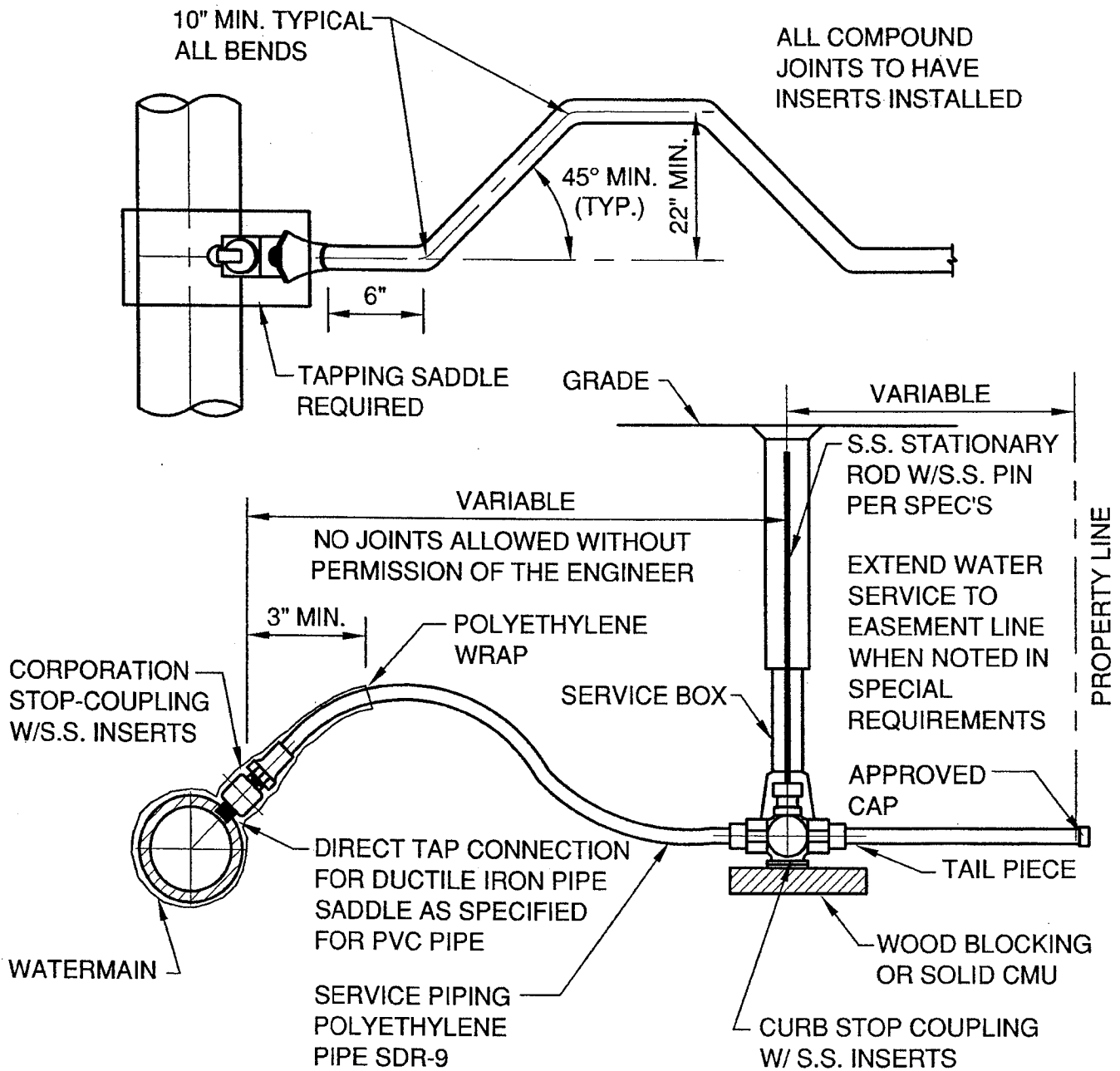
## VALVE BOX SETTING



SERVICE PIPE	CORP. STOP	CURB STOP	SERVICE BOX
1"	1"	1"	2-1/2"
1-1/4"	1-1/4"	1-1/4"	3"
1-1/2"	1-1/2"	1-1/2"	3"
2"	2"	2"	3"

FOR A 2" SERVICE TAP ON  
6" D.I. WATERMAIN, A  
SADDLE IS REQUIRED.

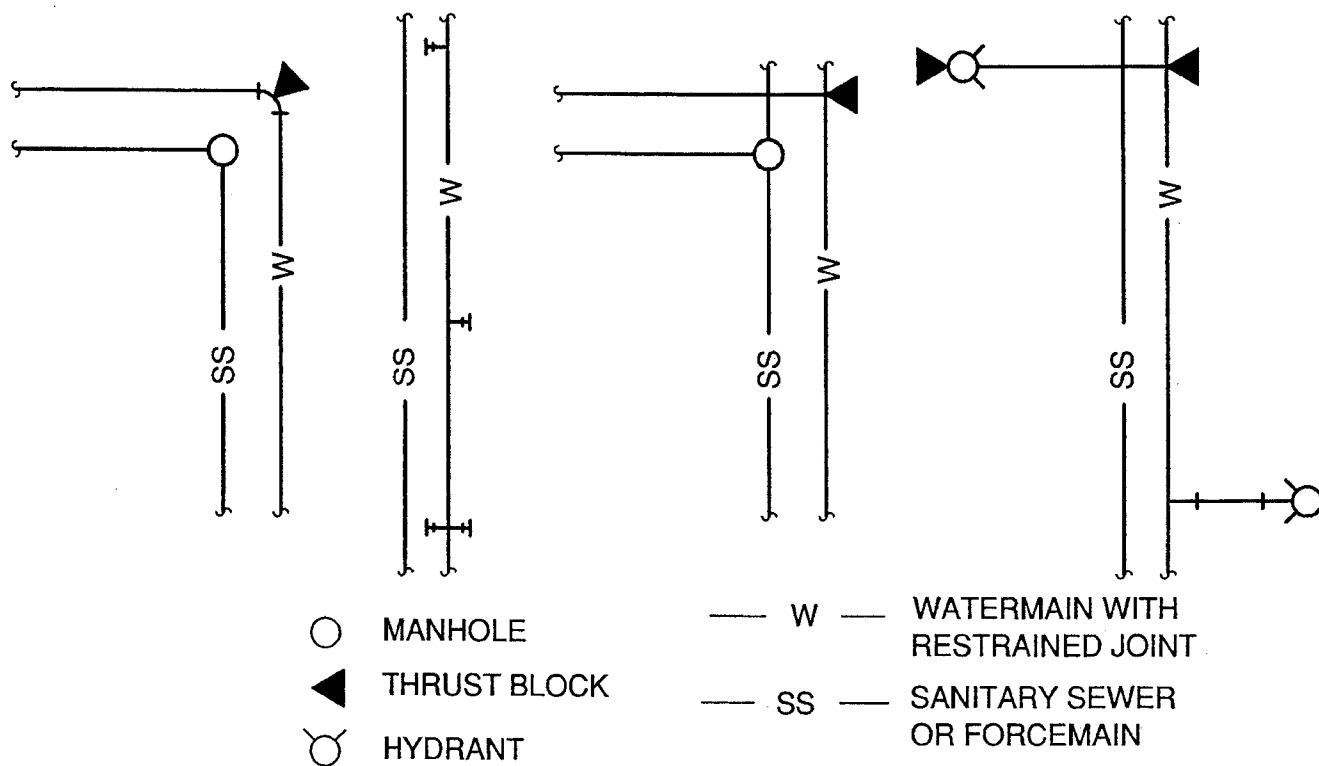
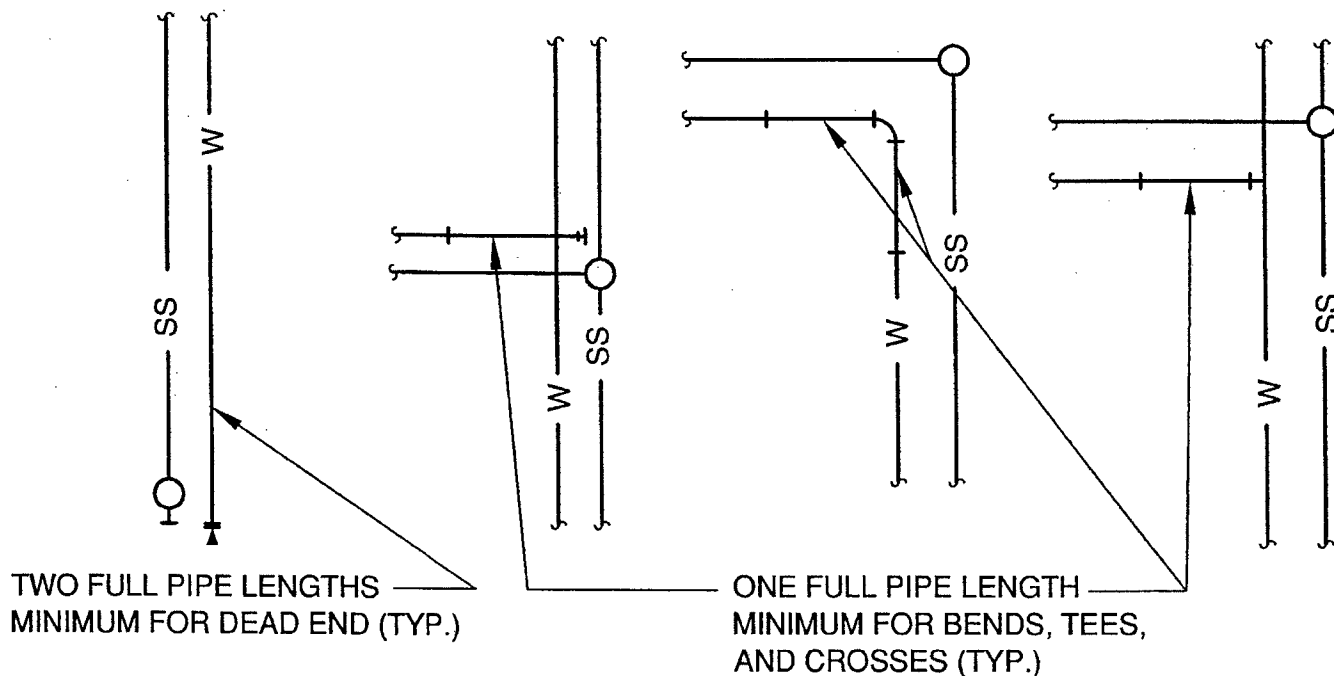
## TAP SERVICE PIPING (COPPER)



SERVICE PIPE	CORP. STOP	CURB STOP	SERVICE BOX
1"	1"	1"	2-1/2"
1-1/2"	1-1/2"	1-1/2"	3"
2"	2"	2"	3"

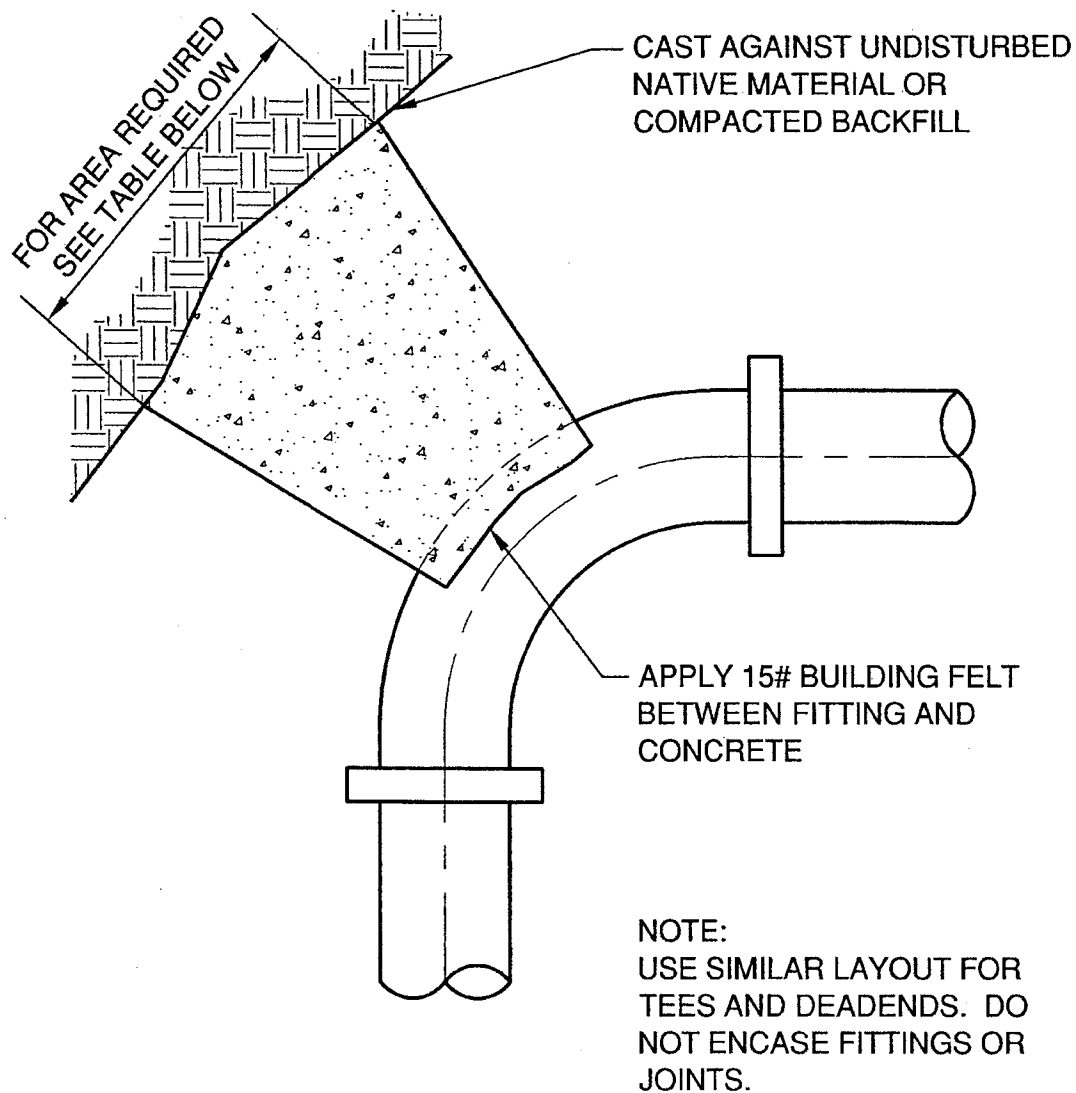
FOR A 2" SERVICE TAP ON  
6" D.I. WATERMAIN, A  
SADDLE IS REQUIRED.

## TAP SERVICE PIPING (POLYETHYLENE)



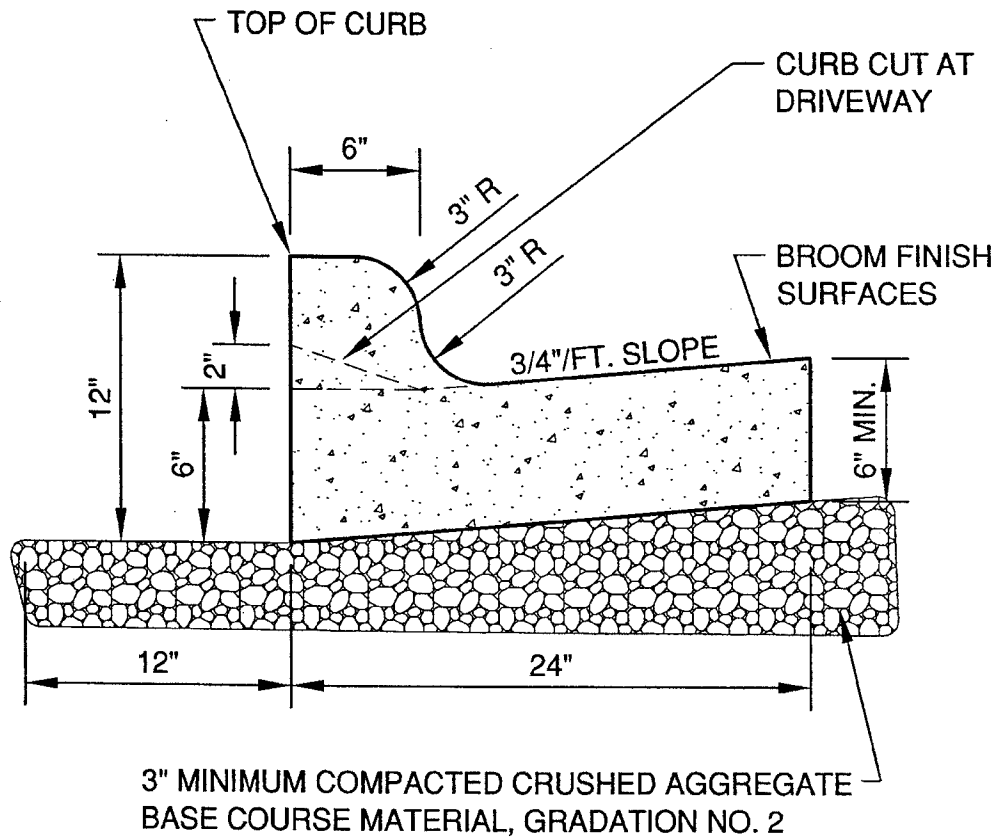
## TYPICAL WATERMAIN RESTRAINT REQUIREMENTS FOR COMMON TRENCH CONSTRUCTION





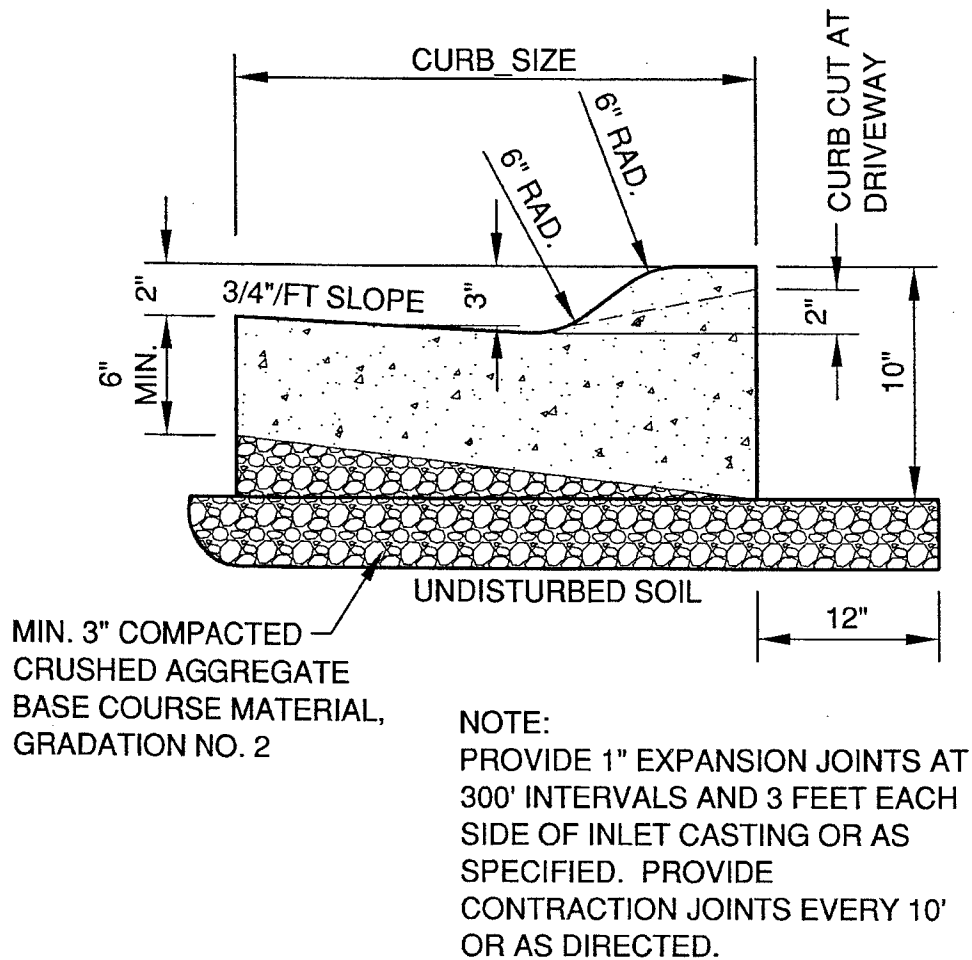
THRUST BLOCK AREA REQUIREMENTS, SQ. FT.				
DEGREE OF BEND	4" PIPE	6" PIPE	8" PIPE	10" PIPE
5° TO 22.5°	0.5	0.5	1.0	1.5
23° TO 45°	0.5	1.0	2.0	3.0
46° TO 90°	1.0	2.0	4.0	6.0
TEE OR DEAD END	1.0	2.0	4.0	6.0

## TYPICAL THRUST BLOCK

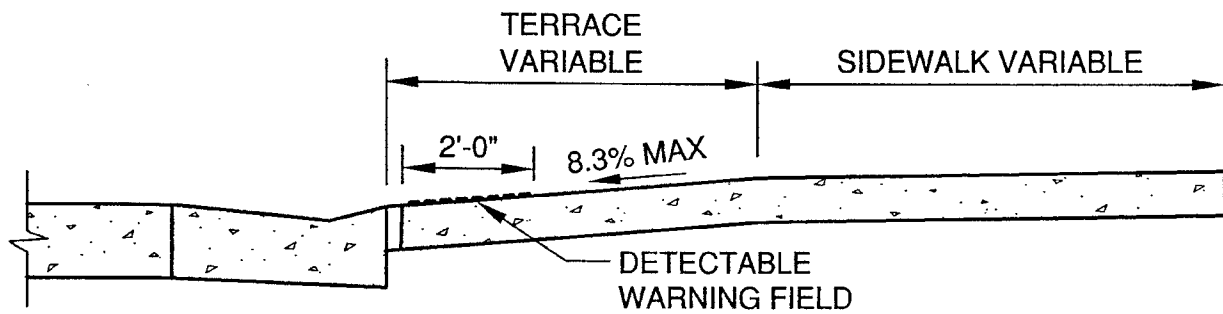
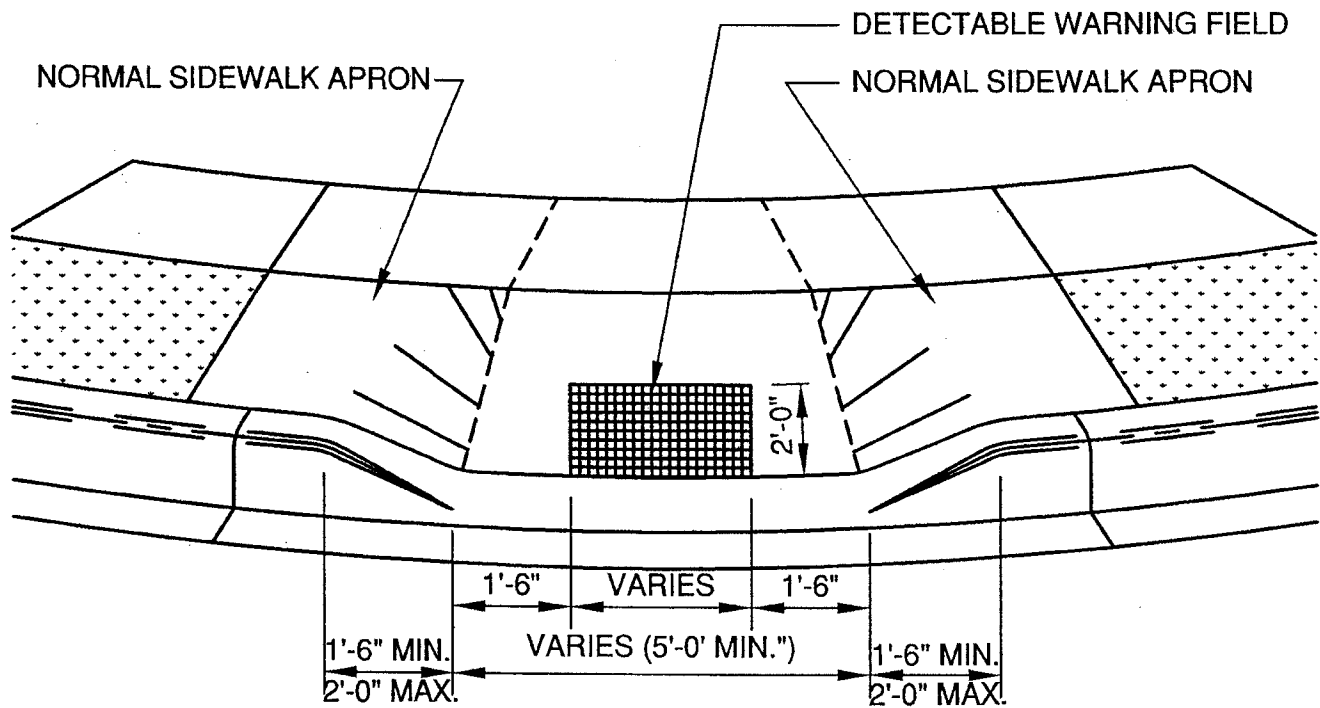


NOTE:  
 PROVIDE 1" EXPANSION JOINTS AT 300' INTERVALS AND 3  
 FEET EACH SIDE OF INLET CASTINGS OR AS SPECIFIED.  
 PROVIDE CONTRACTION JOINTS EVERY 10' OR AS DIRECTED.

## STANDARD CURB & GUTTER

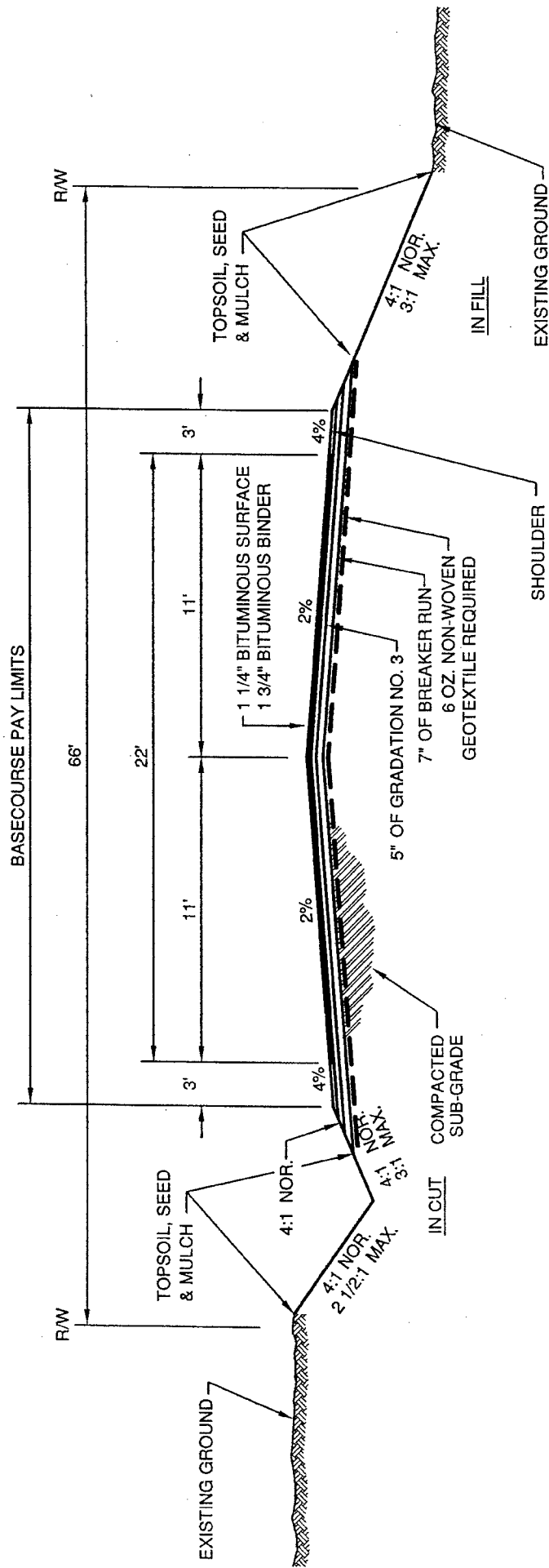


## MOUNTABLE CURB AND GUTTER

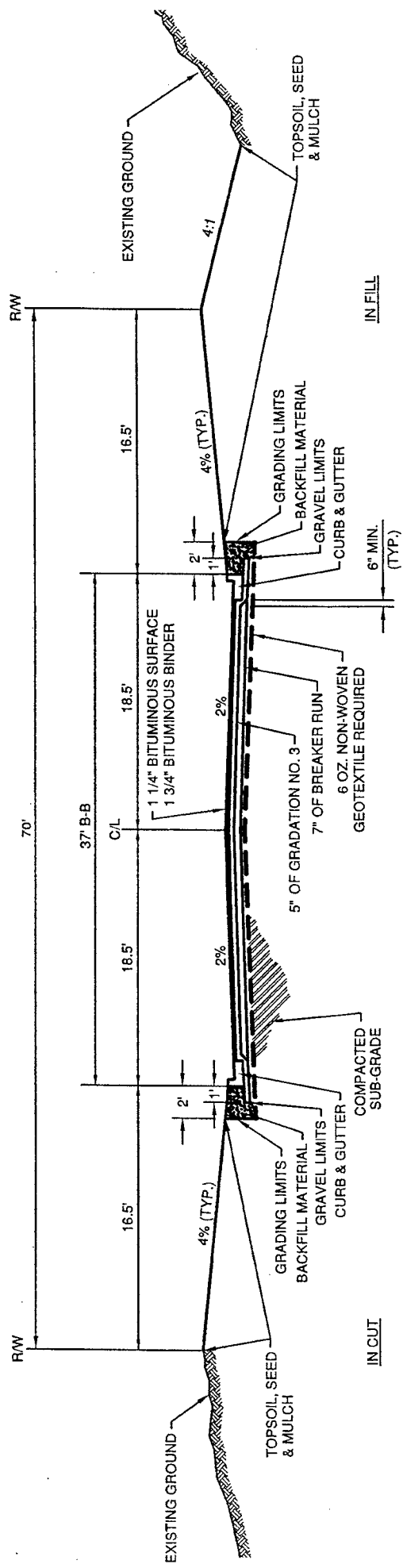


SECTION PARALLEL TO  
CENTERLINE OF RAMP

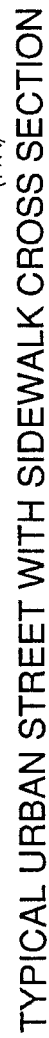
## TYPE I HANDICAPPED CURB RAMP



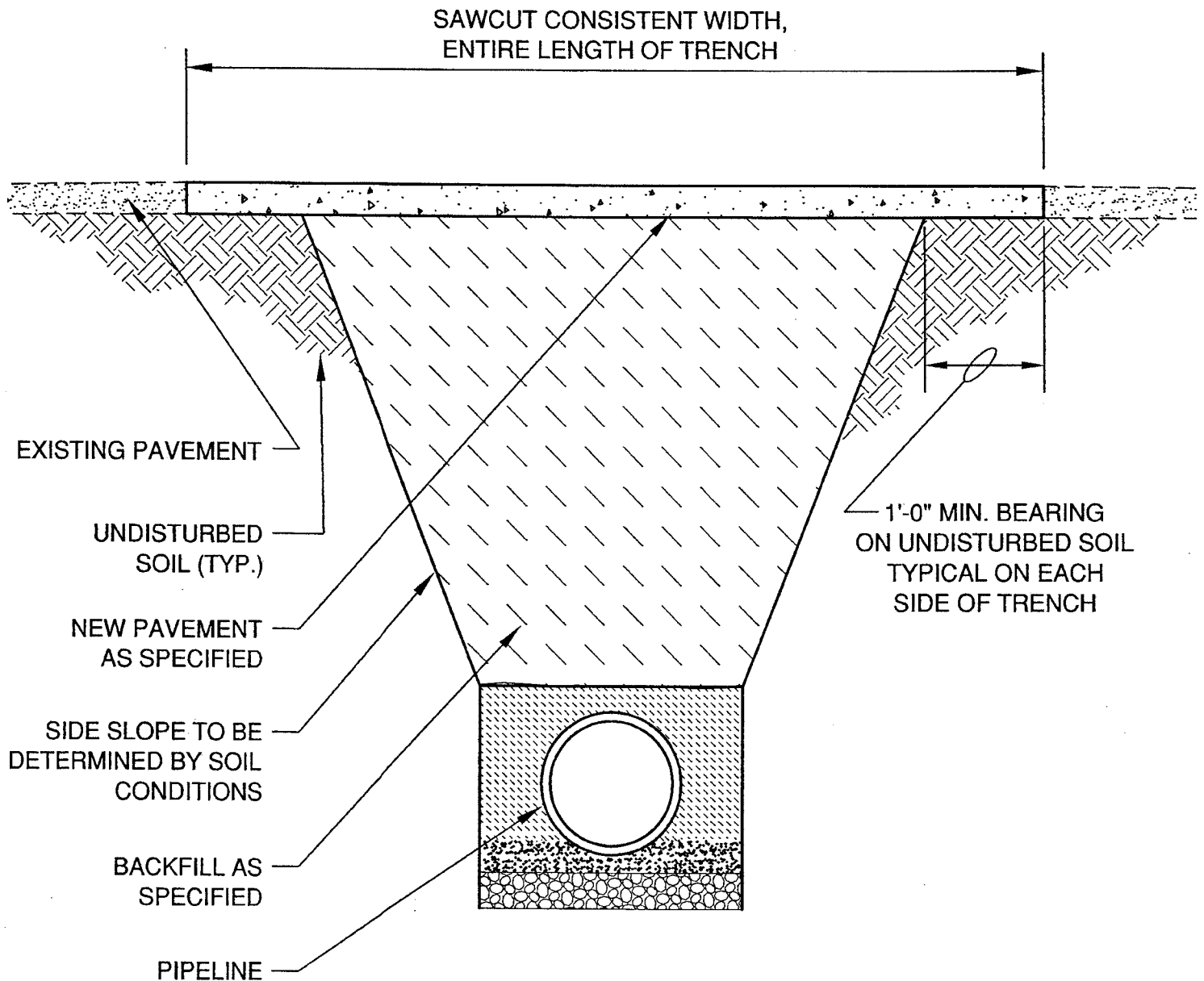
TYPICAL RURAL STREET CROSS SECTION



TYPICAL URBAN STREET CROSS SECTION

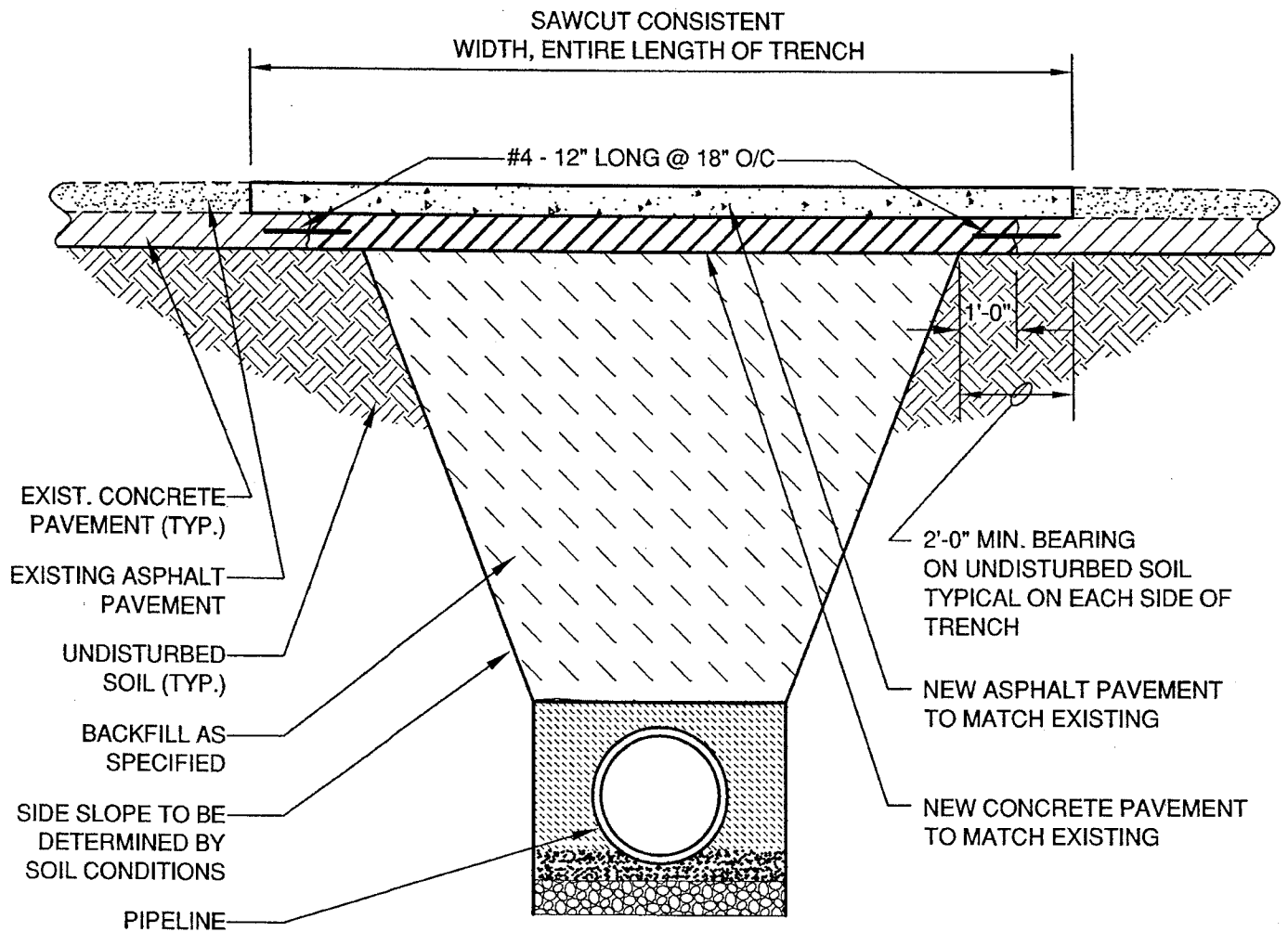


TYPICAL URBAN STREET WITH SIDEWALK CROSS SECTION



## UTILITY TRENCH PAVEMENT RESTORATION





## UTILITY TRENCH RESTORATION WITH CONCRETE



EROSION BALES FOR SHEET FLOW

EROSION CONTROL SHEET FLOW DETAILS						DRAWN	
NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION
							CHECKED
							DESIGNED

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 ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES  
 4864 GOLDEN POND PARK COURT  
 OREGON, W. 97153  
 PHONE: (503) 862-8641  
 FAX: (503) 862-8642  
[www.relee.com](http://www.relee.com)

SHEET NO. **X**

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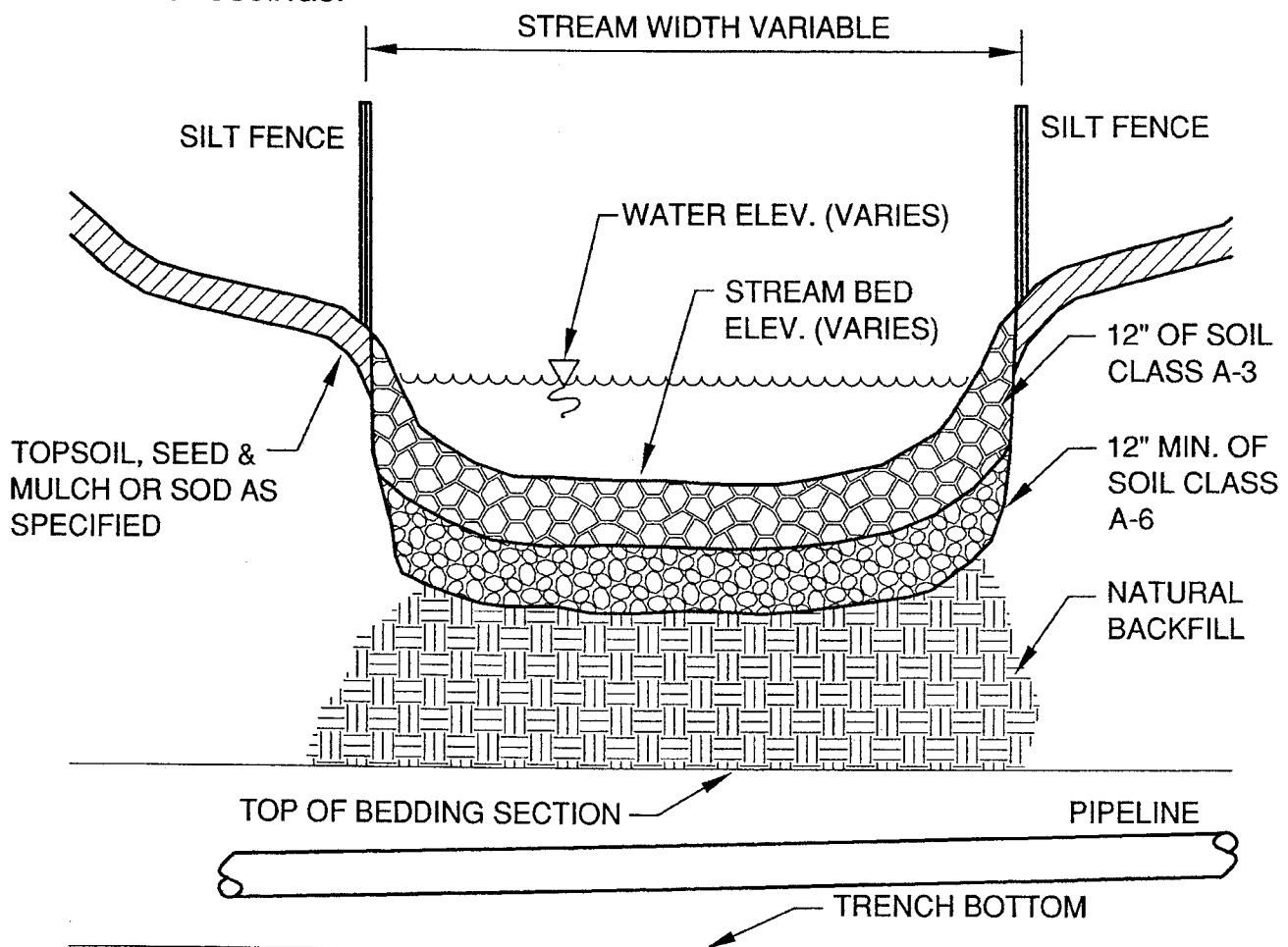
NOTES: IF TOP OF PIPELINE TO THE STREAM BED ELEVATION IS LESS THAN 2'-0", PROVIDE SPECIFIED COVER MATERIAL TO 6" ABOVE TOP OF PIPE. THEN POUR A CONCRETE CAP 3 TIMES THE PIPE WIDTH TO THE EXISTING STREAM BED ELEVATION. CONCRETE SHALL EXTEND  $\pm 5'$  BEYOND STREAM WIDTH. CONCRETE SHALL BE CLASS "B".

THE OWNER WILL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED WDNR AND U.S. ARMY CORPS OF ENGINEERS PERMITS.

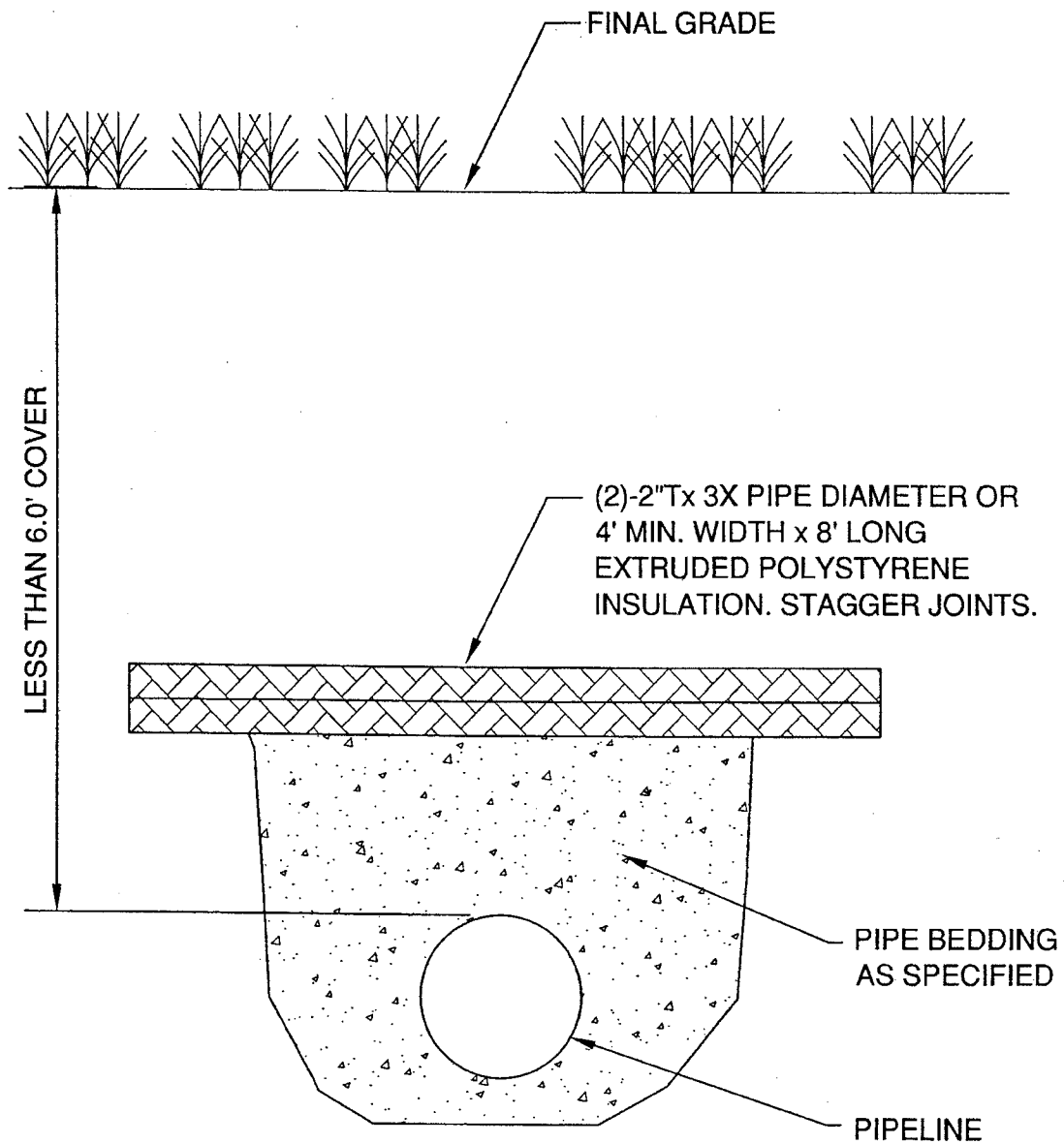
CONTRACTOR SHALL BE RESPONSIBLE FOR MEETING ALL PERMIT REQUIREMENTS.

CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PUMPING AND DISCHARGE PERMITS.

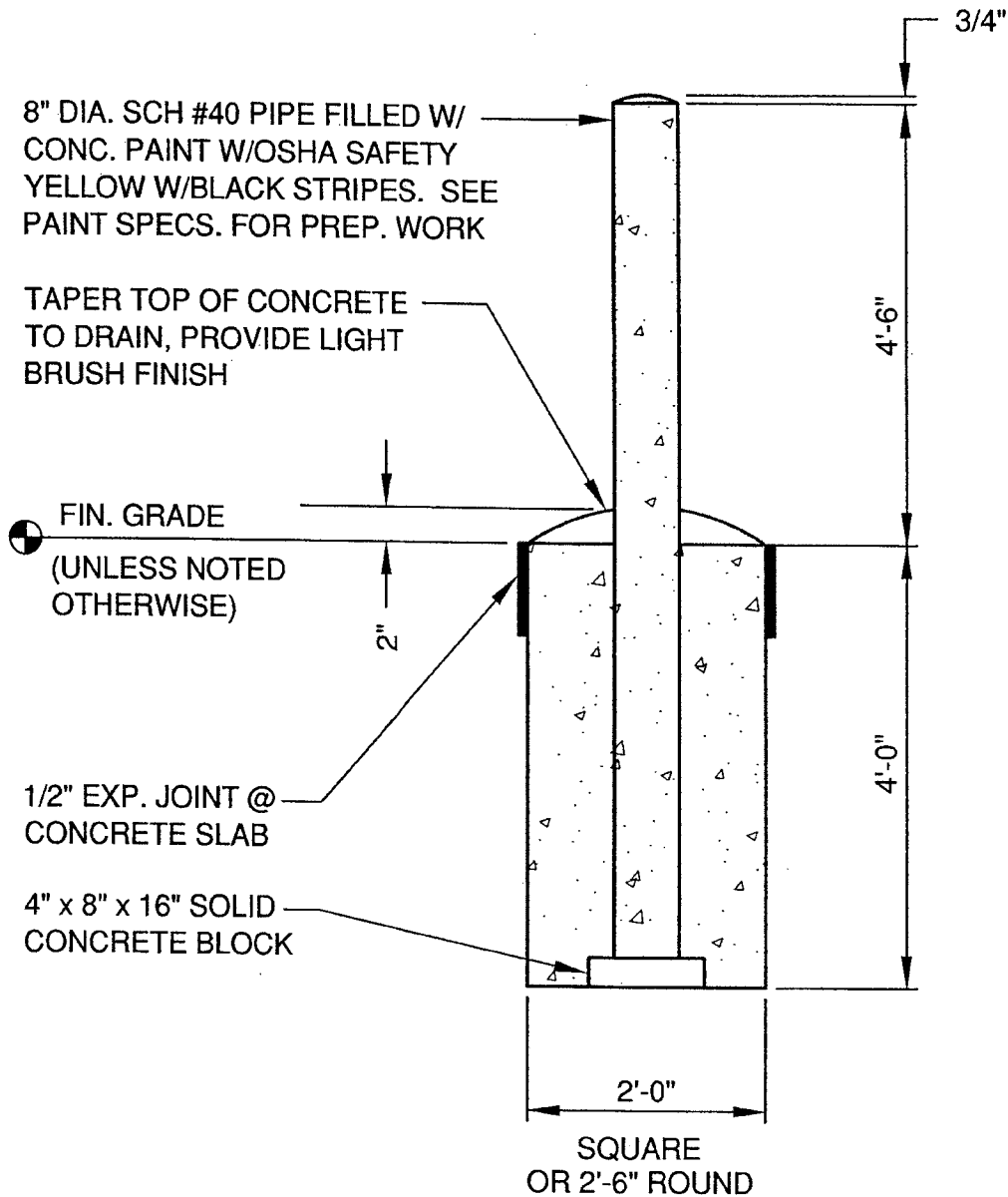
CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST AND MAINTENANCE OF ALL BYPASS PUMPING ASSOCIATED WITH CONSTRUCTION THROUGH CREEK CROSSINGS.



TYPICAL OPEN CUT STREAM CROSSING

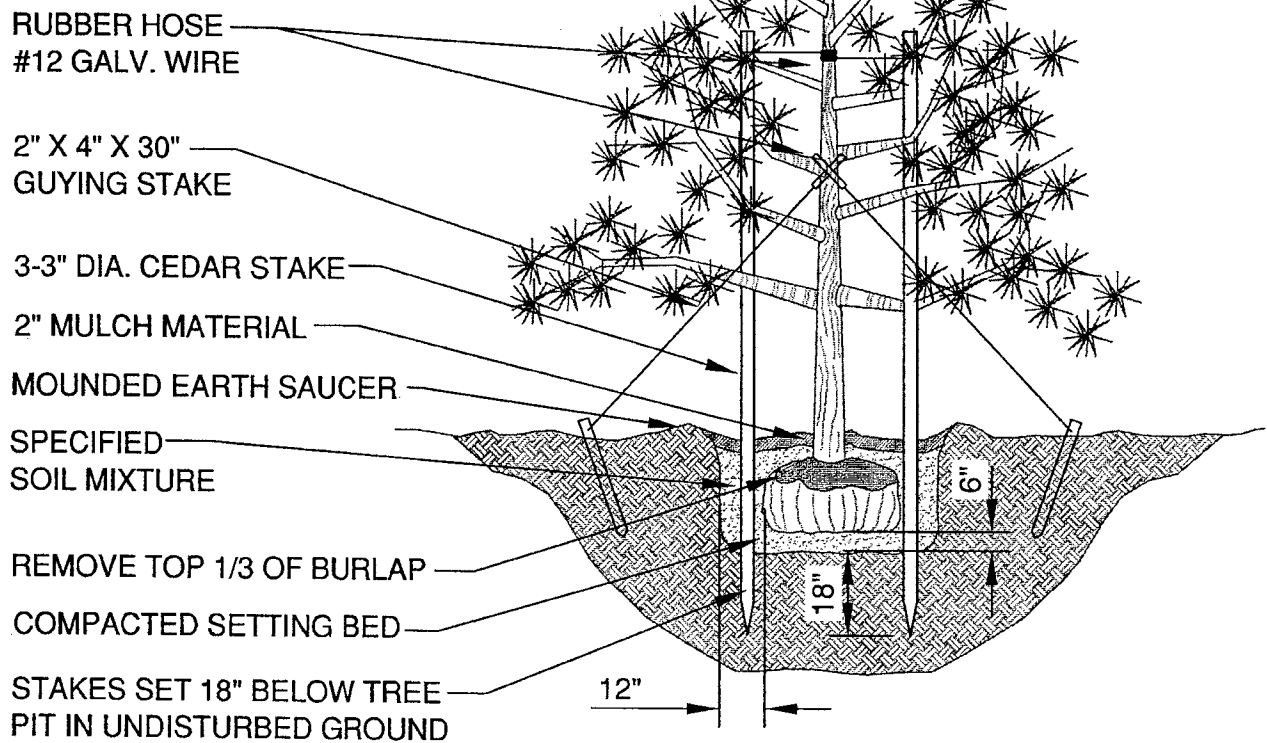


PIPE INSULATION DETAIL



TYPICAL GUARD POST

NOTE:  
STAKE EVERGREEN TREES  
BELOW 8' HEIGHT  
GUY TREES ABOVE 8' HEIGHT



## TYPICAL PLANTING, GUYING & SPIKING EVERGREEN TREE DETAIL



NOTE:  
STAKE TREES UNDER 3"  
CALIPER. GUY TREES  
OVER 3" CALIPER

RUBBER HOSE #12 GALV.  
WIRE

APPROVED TREE WRAP

3-3" DIA. CEDAR STAKE

2" MULCH MATERIAL

MOUNDED EARTH SAUCER

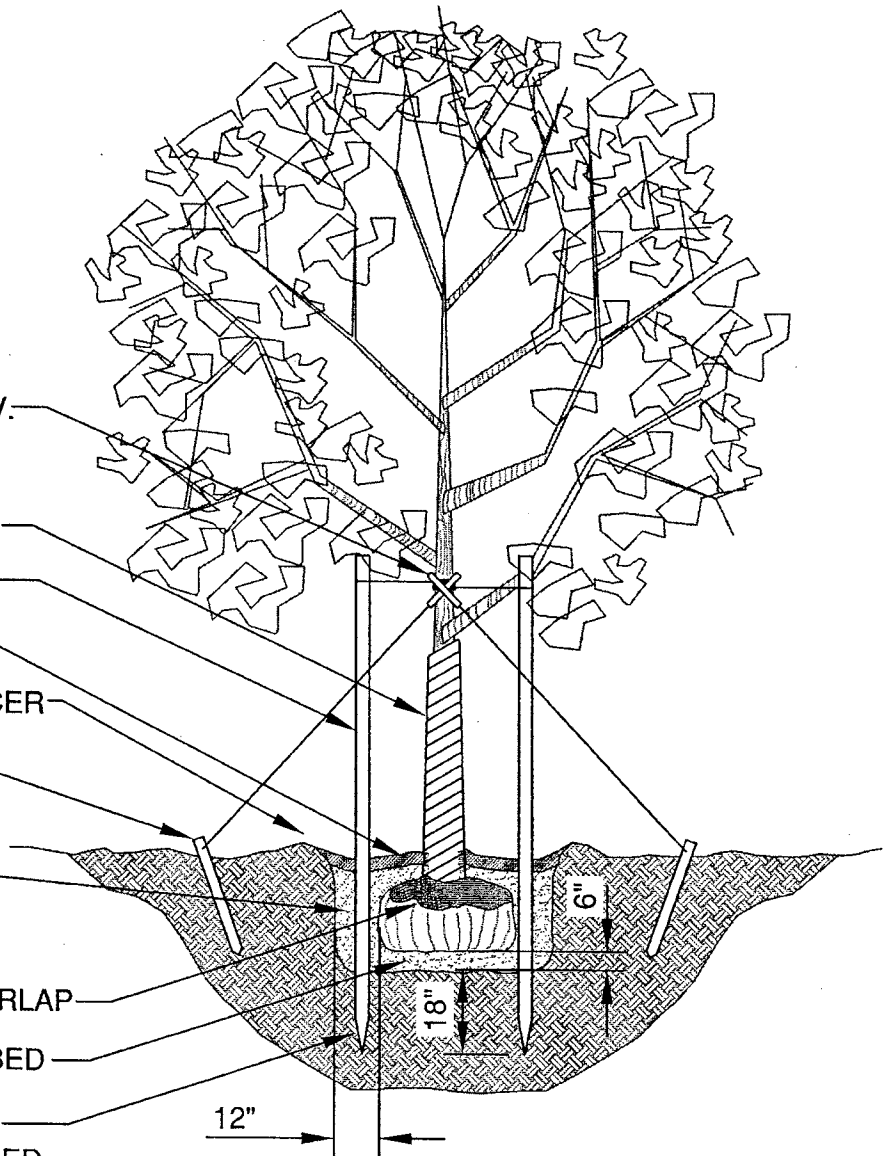
2" X 4" X 30" GUYING  
STAKES

SPECIFIED  
SOIL MIXTURE

REMOVE TOP 1/3 OF BURLAP

COMPACTED SETTING BED

STAKES SET 18" BELOW  
TREE PIT IN UNDISTURBED  
GROUND



## TYPICAL PLANTING, GUYING & SPIKING DECIDUOUS TREE DETAIL